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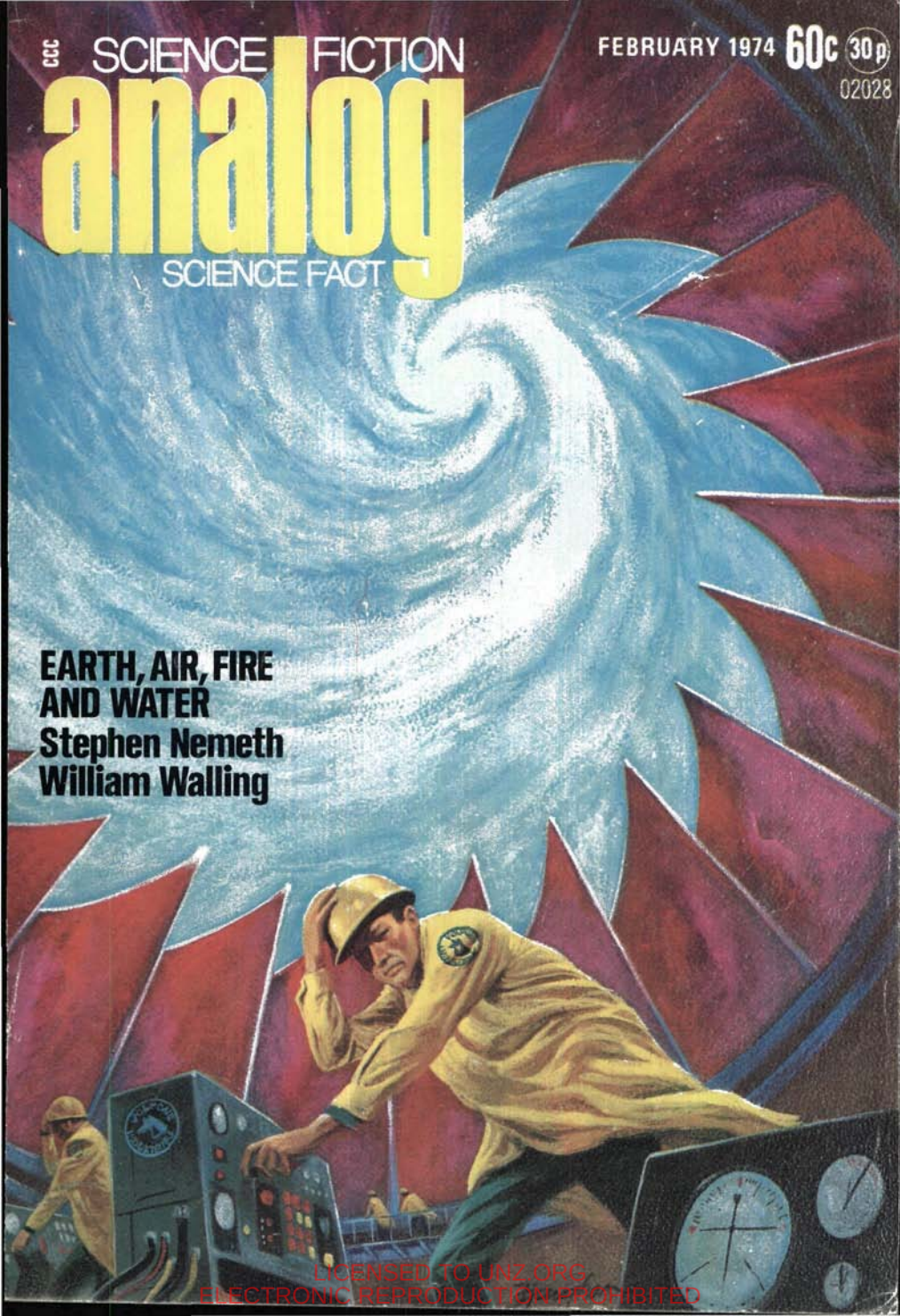

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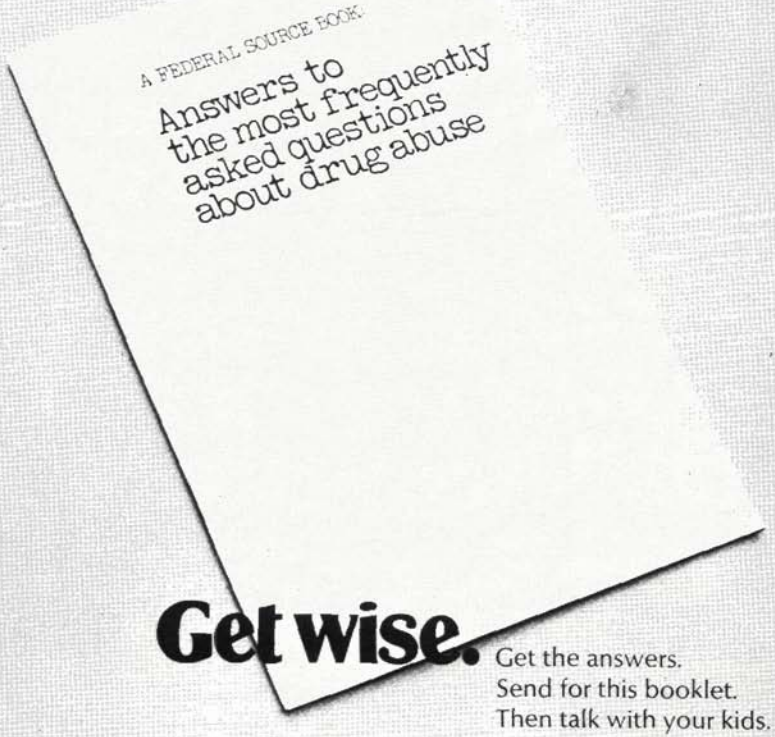

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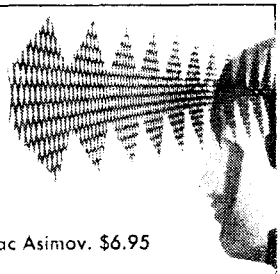

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During the height of the American involvement in Vietnam, when President Lyndon Johnson had sent half a million American troops to South Vietnam and enough bombs were being dropped to make that whole nation resemble the bottom of a shake-and-bake bag, Senator Barry Goldwater reminded an audience of his ill-fated 1964 campaign.

"Remember me?" he asked his listeners. "I'm the nut who wanted to send the Army into Southeast Asia and bomb Hanoi."

Ideas that are first considered eccentric, unacceptable, or even crazy have a way of becoming commonplace, sooner or later. One of the causes of Future Shock is that nowadays, the crazy ideas become Standard Operating Procedure sooner, rather than later.

Back when I was a lad (a sure sign of advancing age, that phrase) nothing was crazier than wanting to fly to the Moon. Well, maybe there were a few things crazier than that: atomic power, death rays, artificial hearts, thinking machines, airplanes that could fly as fast as four hundred miles per hour. Now they're all as normal and as American as pizza pie.

Science fiction abounds with crazy ideas.

Not too long ago, in Analog, Wade Curtis suggested that coastal cities could have plenty of fresh water practically free, if they would just arrange to have an iceberg towed to their shorelines. The average iceberg represents enough fresh water to last a fair-sized city for months.

Crazy idea.

But the US Army's Cold Regions Research and Engineering Laboratory, in New Hampshire, in harness with the US Geological Survey's Ice Dynamics Project at the University of Puget Sound, Washington, has produced a report that shows maybe it isn't so crazy after all. The two authors of the study are Wilford F. Weeks, Army, and William J. Campbell, USGS.

They concluded that a ship with approximately two-thirds the propulsive power of the carrier *Enterprise* could tow from Antarctica to Australia or southern South America an iceberg that would be big enough to irrigate six thousand square miles of land. Such an iceberg would be worth more than one billion dollars. The cost of water from a large, modern desalination plant is estimated to be about 19 cents per cubic meter (264.2 gallons). The price of fresh water

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from the melting iceberg would be 0.8 cents, they calculated.

Crazy idea.

And, of course, it is only in science-fiction stories that you find spacecraft that go faster than light, that utilize crazy things like space warps to get around the light-speed barrier. It's also the science-fiction "nuts" who talk about alternate universes and other dimensions of space/time as if they really existed.

Well now . . . astrophysicists have gone ga-ga over black holes, the potholes in space left when very massive stars or whole galaxies collapse. Theorists have speculated that the collapsing star might actually dig a "wormhole" through space/time and emerge elsewhere/elsewhen in the universe as a white hole—and perhaps that's what the quasars are.

Sounds suspiciously like a space warp to me! Those wormhole tunnels might be just the thing for starships to use as shortcuts from one part of the universe to another. And, in fact, we've already had science-fiction stories in which "collapsar" space warps are purposely made by human scientists and engineers, who can't poke around looking for natural wormholes when they're in a hurry to take a shortcut to Betelgeuse.

And the theoretiker physicists are also muttering to each other, not about the *possibility* of alternate universes, but about the absolute necessity of postulating them, in order to save the foundations of physical theory!

Seems that the uncertainty principles of modern physics lead to an unpleasant paradox. Theoretical considerations tell us that for any given decision-point in the universe—say, whether or not you'll blink your eyes before you finish this phrase—there's a fifty-fifty chance for the decision to go either way. Yet in our real world, you either go a hundred percent one way or a hundred percent the other. You either blink your eyes or you don't. There must be, the theoreticians conclude, a universe in which the other decision holds true. For every decision-point in this universe, there is an alternate universe in which the decision went the other way.

There must be googols of universes! Some exactly like ours, right up until a moment ago; others that branched off ages ago, when the dinosaurs became intelligent (for example).

Crazy. The stuff of science fiction. Except that it's been discussed in the highest circles of theoretical physics.

Science-fiction writers come up with all sorts of weird ideas. Many of them—such as the negative income tax—they borrow from the "straight" world. Others, such as an international struggle over the natural resources of the oceans, they make up out of whole cloth—only

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to have the "straight" world borrow it from them.

One science-fiction idea that seems definitely on its way to reality is the universal credit card, and the eventual elimination of cash money. However, anyone who's tried to argue with a computer-smug credit card organization can testify that the day of the credit-card-economy won't dawn until both the machines and the people get a lot smarter. It's chilling to hear a pleasant-voiced young lady ask, over the phone, for your card number so that she can check out the discrepancy in your bill that you're complaining about, and then have her come back saying, "Ah yes, here's your file, Mr. Pagropoulis . . ."

In fact, one of the more frightening predictions of science fiction is that our society is moving toward more centralization, more bureaucracy, more impersonal machine-dictated handling of *my* life.

There's no fundamental reason why this should be so, except perhaps some of the ramifications of Parkinson's Law.

Parkinson's Law, simply put, is: Work expands to fill the time allowed for it. And one of the subtler results of this universal law is the burgeoning of bureaucracies. If one man decides he can only get a raise by becoming the boss of two other men, he will scheme and wheedle and cajole until he gets a

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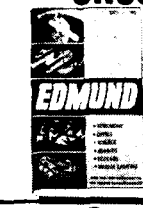

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couple of men to do the work he originally did alone. His time will be spent "supervising" his two assistants. And since they are now sharing the work their boss formerly did, it stands to reason that neither of them can be as productive as their boss.

This kind of frightening built-in mediocrity can be found in business firms, government agencies, universities, even churches: wherever large numbers of people gather to work together. The fact that they are frequently working *against* each other helps to explain why the output of bureaucracies is so low.

What can be done about this?

A science-fictionist's answer might be deceptively simple: replace the bureaucrats with computers, and leave only a few brilliant and dedicated men and women at the top of the organization to run the computers. After all, the archetypical bureaucrat is simply a person who "goes by the book" at all times—that is, he follows his original programming. *And he resists, with every ounce of passion he can muster, any attempt to change the programming.*

A computer can follow the program better than a human, and it can be reprogrammed rather simply. At worst, you'd have to pull out some circuit boards and interior wiring, which is done much more easily to a machine than to a human being.

But this kind of simplistic cure is one of those crazy ideas for which the world is not yet ready. For one thing, the bureaucrats themselves would never allow it. Unless, of course, things were arranged so that the number of computer routines a bureaucrat had cognizance over was just as important—or more so—than the number of assistants he or she could pile up.

But bureaucracies are, by virtually every test, a form of living organism. They eat, grow, breed, resist change. It may well be that the first—and only!—immortal creature on this planet is the bureaucracy that began in the ancient Roman Republic and survives today within the Catholic Church.

The only way a bureaucracy can continue to exist, though, is if there is no way to measure its performance. How many souls has the Catholic Church brought salvation to? There is no way to tell; the Church may be doing a splendid job. But no one on this side of heaven can objectively state that this is so.

So—perhaps the only way to change a moribund bureaucracy into a dynamic force for human achievement is to find some way to measure *objectively* the bureaucracy's performance.

How do you know if your local school board is doing an effective job? It should be possible to test the students on their reading skills, and compare the results to the na-

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tional average or some other agreed-upon standard of excellence. If the kids don't measure up, then neither do the members of the board. Get rid of 'em!

How can a corporation president tell if his public relations department is performing adequately? One way would be to give the whole department a six-month vacation with pay, and see what happens to profits. In most corporations, profits will rise slightly, because the day-to-day costs of expense-account lunches and typewriter ribbons will not be incurred for six months.

A modicum of thought will show myriads of ways in which even the most impenetrable bureaucracy can be thrown into the cold light of objective, rational examination.

Perhaps the biggest and most dangerous bureaucracies are the political ones—the government agencies that consume tax money and produce little but aggravation. These are more firmly entrenched than most bureaucracies, thanks to the Civil Service regulations that were originally set up to safeguard honest workers against the rampant politics of the spoils system.

The place to start reforming the political machinery is at the top—with the politicians themselves. The basic problem with most politicians is that they are convinced that the most important thing in life is for them to be re-elected. So we must dissuade them of that belief.

We have already dissuaded the occupant of the White House from believing that he has a chance to be re-elected more than once. The Twenty-second Amendment to the Constitution limits the President to no more than two terms in office.

Might it not be a reasonable idea to extend this concept throughout the root and branch of our political system? Why should anyone serve twenty terms in the Congress? Is this nation so poor in talent that certain men must grow into their dotage in political office? Why not make it mandatory that no office-holder can serve more than two terms?

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This is bound to produce a "get up or get out" syndrome among politicians. Instead of working for re-election to the same office, they'll be struggling manfully (or womanfully, as the case may be) to get elected to a *higher* office. There's more prestige, it pays better, and the opportunities for graft will be larger—if that's the kind of politician we're talking about.

But this motivating force might work out to the benefit of the taxpayer. The politician might actually have to accomplish something that pleases the voters before he can seriously consider himself a candidate for higher office. After all, there are four hundred and thirty-five Congressmen in the US House of Representatives, and only a hundred Senators in the Upper Chamber. If a Representative were limited to two terms and wanted to move up to a Senator's seat, he just might be tempted to be an effective Representative.

Crazy idea, of course. It would never work. But if it were tried, it would have to be installed in parallel with another, even crazier idea: universal public service.

The root problem of American politics is that most Americans don't work at it. Most of us vote, and we don't even do that as intelligently as we should—particularly in local elections.

But if we are ever to break up the governmental bureaucracies that surround us at the local, state, and Federal levels, then we must—all of us—be willing to put a few years of our lives into public service.

Everyone in the nation could be drafted at age eighteen, man or woman, no exceptions except physical or mental incapacity. This would provide an army of workers who would serve in the governmental agencies for two years each.

Everyone in the nation could be drafted again at age forty, with more lenient exemptions (possibly) to provide a corps of leaders for the youngsters. Many Americans are finding that they want to change their life-style at about age forty; a year or so in public service would be a good chance to review their lives, see where they've been and where they'd like to go.

And it would be good for the community, the state, the nation. When each of us realizes that he or she is going to devote a few years of service to the community, then we might begin to demand higher standards of performance from our governmental agencies and our elected representatives. It's only when the inner workings of the organization are laid bare that we can reasonably understand what can and cannot be accomplished.

But that's just one of those crazy science-fictional ideas. It'll never work. It's just as silly as expecting a President as "hard" on Communism as Richard Nixon to visit Peking.

THE EDITOR

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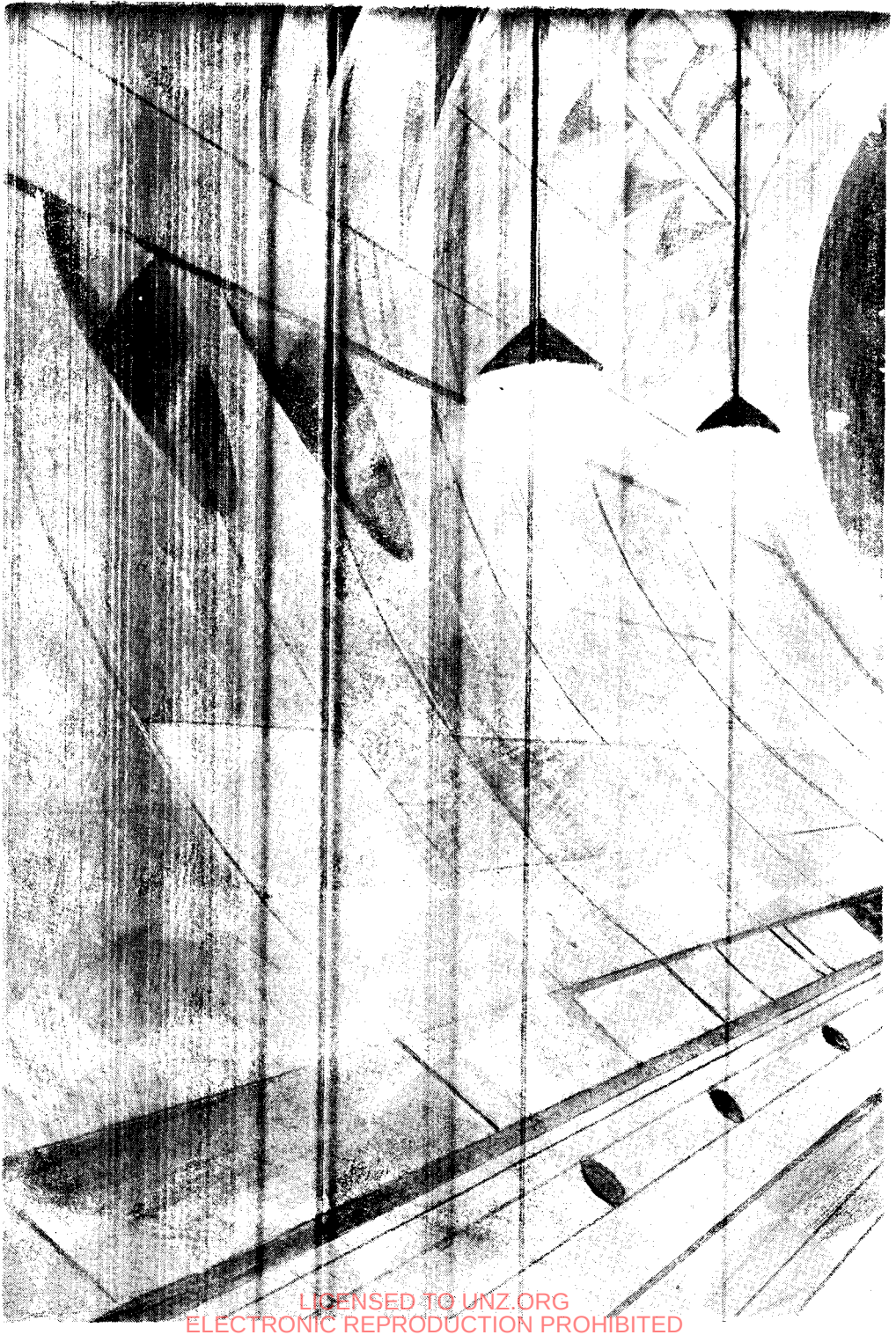

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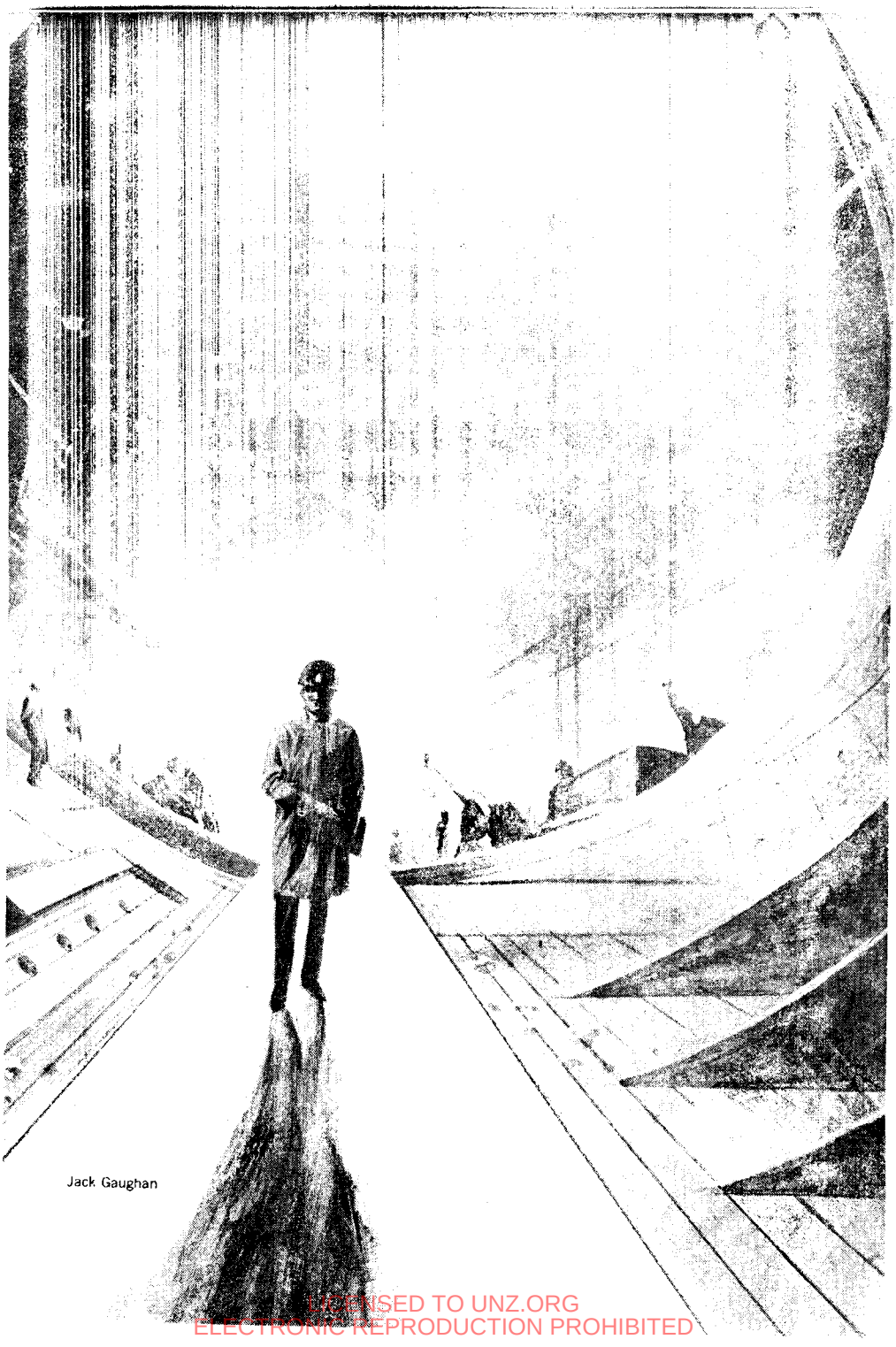

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Prologue
July, 1969

For a major event watched avidly by untold millions of viewers, the TV production was atrocious; the lighting abominable, the video definition poor. Nebulously, a booted foot groped downward from a silhouetted ladder; a backlighted, spacesuit-encumbered figure, wearing life-support equipment, felt gingerly for the LM's dish-like landing pad. The astronaut hesitated for one heart-stopping instant, then stepped outward to lay a pristine footprint in ageless lunar dust.

"Bravo!" Alessandro Volpone surged up from the white settee popping hoarse, benedictive profanities. He performed a little war dance across the luxuriant shag of his study. "Leonard," he said, "I'm a man of guarded enthusiasms, but did you *hear* him? '—one giant leap for Mankind'."

Leonard Colo's lips curved in a grudging smile. "They are much men, these astronauts; no doubt of that. But, will landing on the Moon open a practical technological door, or is it simply a very dramatic stunt?"

"Stunt!" In his mid-forties, Volpone was large-boned, robust, mahogany-tanned from hours of poolside lounging at Foxhaven, the Volpone family mansion. Bushy, high-arched brows framed his dark eyes, now smoldering with banked fires of speculative resentment.

"Stunt," he repeated in the rich *basso*, rising full-flower from the depths of his broad chest. He studied his financial manager, chortling with gentle sarcasm. "Leonard, you've just witnessed the grandest achievement ever sponsored by our human species, and all you can see is a carnival trick."

"Isn't it?"

"It is *not*," said Volpone heatedly. "Blundering, victimized America has beaten those conniving vermin on the other side of the globe. The Moon landing itself may prove nothing. But attendant publicity will tip the pendulum of international opinion *our* way for a change. Mark me!"

"Twenty-five billion dollars' worth?" asked Colo bluntly.

"Billions—*trillions*—cost be damned! Dare we assign dollar values to such milestones? Think of it: the Moon!"

"Dare we?" Colo's fragile smile evidenced doubt. "You begin to sound like your father, Alex. For me, everything must equate in terms of dollars and cents. I observe the flow of dollars—"

"And provide a pitiless sounding board for my wild schemes." Volpone grinned hugely. "That's your true talent, Leonard—and my single most valuable asset."

"Thank you." Colo's voice was dry, colorless. "I admit that your

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latest 'wild scheme' has me a trifle concerned."

Volpone sobered. "Our bid on the tube transit equipment?"

"Yes. I think your—our—bet rides on a doubtful entry, Alex. The horse may run well, if he's ever allowed to leave the starting gate."

Volpone pinched the bridge of his generous nose, hesitating beside the window to ponder the dim, twilit outline of a dense growth of maples, lining the road toward Lloyd Harbor, which framed a darker patch of Long Island Sound. "Calculated risks are connected with any proposal," he said slowly. "Our competitors—tight, small-minded penny pinchers, every one—as well as the fuel and power interests, have fought adoption of the gravity-vacuum tube transit system with every conceivable weapon. But our Washington pipeline has leaked the fact that operational economy, plus low easement and right-of-way costs, have heavily weighted DoT's trade-off studies in our favor."

Volpone paused, glowering at the smaller man. "Be reasonable," he requested humbly. "Our proposal cost less than two hundred thou. If only *one* segment of the Northeast Corridor Network actually gets built, we'll show a handsome profit."

Colo nodded sagely. "*If* the horse isn't scratched."

Alex Volpone sighed. "Leonard, Leonard; there are no sure things in this precarious world. It has to be an excellent bet: a clean, tremendously efficient innovation in mass transit, tucked neatly out of sight subsurface, providing aircraft speeds, near-foolproof safety, and gravity compensated acceleration-deceleration passenger comfort.

"You've watched the model work, listened to Dr. Seymour's pitch on the compressor equipment we're to build. Can you ask more than CompAir's chance to participate in such a gigantic enterprise?"

"*If* the horse is allowed to run," maintained Colo doggedly. "And *if* young Seymour's blue sky approach proves feasible in this, the real world."

"Again?" Volpone looked sharply at the dapper, elderly accountant. "Has Dr. Powers complained about Seymour again?"

"Powers, among others," conceded Colo. "The R&D team is evenly split, pro-Seymour, and anti-Seymour. You can imagine what sort of working atmosphere *that* creates."

"Hummph!" Volpone's eyes narrowed. "Have Seymour stop and see me tomorrow morning," he said, resignation in his deep voice. "I hired him on the strongest possible recommendation. But we'll not suffer a maverick among our staff scientists, no matter how exceptional."

"You've already spoken to him twice," reminded Colo.

Volpone looked up, his thick

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brows knitted. "So I have," he said firmly. "But I hired him personally, Leonard. This time, if he doesn't settle down, I fully intend to sack him!"

Arriving early Monday morning at his thirty-fourth floor mid-Manhattan lair, Compressed Air Corporation's voluble board chairman exchanged greetings with only the elevator operator, the security guard, and the omnipresent Leonard Colo. At eight-thirty, a pair of commercial artists showed him some rough sketches of a stylized blue-and-silver foxhead device encircled with the legend *Volpone Enterprises,* a name he'd tentatively chosen for the conglomerate, industry-wide holding company he planned to erect upon CompAirCorp's firm foundation.

Volpone did not act overly enthused, suggesting a longer nose for the fox, and the label *Volpone Industries.* The artists left, sounding discouraged. He leafed idly through his calendar, noting that Arne Seymour's name had been scrawled in the eight-forty-five slot. Seymour—a damned nuisance! The young staff physicist's bold audacity had rather intrigued him in the beginning. An interesting fellow, Seymour, if one overlooked his touchiness, his overweening ego, his obdurate reluctance to take direction, *and* the insufferable bluntness which blossomed into outright rudeness upon the slightest provocation. But his overall effectiveness was unquestioned: Arne Seymour had but one style—attack! He assaulted major and minor assignments alike in the manner of a karate expert demolishing a column of bricks, neglectful of where the shards flew, or whom they might injure. Seymour met all objections to his highly original, unproven methods with scalding logic, with equations that proliferated like epidemical bacteria cultures, and with stubborn refusal to consider what he unblushingly referred to as the "stupid" solutions of others.

Seymour's mind, Volpone had discovered, was far-ranging and—ignoring his infuriating manner—possessed of an uncommon fund of general knowledge. But the man had absolutely no charm or tact, which was unfortunate. Volpone had looked forward to bringing Seymour around, to graduating him, so to speak, from the Volpone "school." His father had bequeathed him definite views about wasting potentially profitable raw material—human and otherwise. Thoughts of losing Seymour were galling, causing a pang of anxiety.

When his secretary buzzed to announce Seymour, moments later, Volpone covered the half-year marketing reports on his desk and leaned back, relaxed. The door to his paneled office was flung wide without benefit of a knock. The pale, thin physicist charged in as if the building were on fire, white

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shirt rumpled, carelessly knotted purple tie askew.

"Come in; come in," invited Volpone needlessly.

Seymour augmented his other social graces with a total ineptitude for small talk. "You wanted to see me?" he demanded, his voice high-pitched, irritating, yet perfectly controlled.

"Er, yes." Volpone sounded distantly amused. "Arne, you came to us—let's see, nearly a year ago, isn't it? Your technical progress has been exemplary. In fact, your performance on the tube transit studies tempted me to give you a lab of your own, free rein to do pure research. How would that strike you?"

"I'd like it," blurted Seymour.

"Fine, fine!" Volpone tugged fitfully at one earlobe. "In the meantime, I want you to prove yourself a cooperating member of our team here at CompAir. Dr. Powers feels concern—"

"Powers," said Seymour, making it a simple statement of fact, "doesn't know his ass from third base."

Alessandro Volpone's lips twitched; the pulse beat at his temple quickened. "I was about to say," he continued, a burr in his voice, "that Dr. Powers is now sixty-three. He will soon—"

"If you're going to fire me," suggested Seymour, "get on with it. I have things to do."

Volpone lurched to his feet, scooting his castered armchair into the unoffending bookcase behind him. He bowled his way around the desk. "You," he growled, "are an intellectually arrogant, thoughtless, and thoroughly reckless young man."

Seymour's innocent blue eyes bulged behind thick lenses. "Now the vendetta," he said, his face maddeningly immobile. "The empire-builder, wounded in his only vulnerable spot—his pride."

"Perhaps I am a prideful man," admitted Volpone. "You may leave now, Seymour. I don't care to listen to your apology, even if you have one in mind."

"Apologize for what, the truth? All you care about is money."

"Money!" Nostrils flaring, Volpone took firm hold of his temper. He began prowling between Seymour and the large picture window. "Truth," he asserted, "is a fragile, intangible ideal. Money, on the other hand, is the diamond-hard pivot upon which this weary world spins. Money isn't everything, no; but whatever's second is quite some distance back. Someday soon, when you are without it, you may begin to appreciate the deeper meaning behind 'money'."

"Spend yours," advised Seymour with a knowing smile. "Enjoy yourself while you can. You probably have time left."

"I fully intend . . ." Volpone folded his long arms. "Time left? What, in the name of sweet Ever-

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lasting, does *that* mean?"

"Why," said Seymour in a beguiled tone, "I thought even tycoons read newspapers. Open your eyes! The US is preparing in Vietnam just as Japan practiced in Manchuria thirty years ago, as Italy warmed up in the Ethiopian highlands. The USSR is getting ready in the Mideast, like Hitler did in Spain."

"Preparing for . . . er, nuclear war?"

"Hardly." Seymour looked cunning. "Neither side wants that. Ours for obvious reasons, theirs because the wise old Soviet marshals don't want to own a heap of rubble. As for China, guess. Or better, try to *buy* the answer with all your money."

Volpone's dark eyes glistened. "Do you believe this nuclear stalemate will continue indefinitely, or—?"

"Hell no! Only until the balance of power—and the odds—favor *them.* Brushfire wars will break out at high friction points like Southeast Asia. I suspect one's brewing now in Israel. They'll bleed us white, militarily, economically, morally. We'll go fascist—a police state with all the trimmings—or go *under.*"

"Hm-m-m, not an entirely original speculation, but . . ."

Seymour waved his hands, excited at last. "They've already undermined our will to fight, our aggressive instincts. Look at the spreading use of narcotics, the conscription rebels, student militants, organized revolutionaries—minority, and otherwise. Social patterns like those don't start by spontaneous generation, Mr. Volpone. How many millions of rubles do you suppose the Soviet Union spends annually on subversion?"

Volpone blinked repeatedly. "We're straying far afield," he said. "For a scientist, you make an entertaining prophet, Seymour. I wish there were time to listen to your philosophies."

"There is a way," said Arne Seymour smugly.

"A . . . way?"

"A sure way to defeat the stalemate, bring them to their knees. It's certain, quiet; no muss, no fuss, unless they panic and push the button. Even then, we'll have a few hundred thousand worthy survivors salted away. They'll have almost *no one.* Here's the clincher," said the physicist, standing much too close to his employer. "There is *no possible way* for them to recoup the lead once we have, say, a four- or five-year headstart."

"Fascinating." Volpone edged away, scowling.

"It will take decades," said Seymour, "and could cost tens—even hundreds—of billions, but it will—"

"Billions!" Volpone's laugh was caustic.

"I'm perfectly serious," insisted the annoyed Seymour. "It's a natural corollary to the interurban tube

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transit concept. I was going to approach you after a few more weeks' research, but . . ." Seymour cleared his throat. "I, uh, want to stay on at CompAir, Mr. Volpone. You're smart enough, tough-minded enough, not to let silly moral considerations stand in your way. And you're wealthy enough," he added.

"Why, thank you, Arne." Volpone looked benign. "Am I to understand that you're pleading with me to stay?"

Seymour nodded, staring fixedly out the window.

Alex Volpone laughed heartily. "Like hell you are! You're *demanding* that I keep you."

"Call it . . . what you will. Shall I tell you about it?"

Volpone shrugged. "My first inclination is to take you by the scruff of your scrawny neck . . ." He glanced upward at the office clock. "I have an important meeting in twenty minutes—at nine-thirty—which allows you just nineteen minutes, Seymour. It will take far less than one whole minute to fire you."

"Good. We'll use the conference room," said Seymour over his shoulder. He disappeared through a side door.

Rocking his leonine head in wonder, Alex Volpone trudged after the physicist. He lighted a cigarette and settled himself behind the conference table with an air of heavy-lidded resignation.

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Seymour pouched his cheeks several times in thought. "As you know," he began, "Earth's atmosphere consists of roughly twenty percent oxygen, seventy-nine percent nitrogen, and one percent argon, xenon, and miscellaneous gasses . . ."

Arne Seymour assaulted his subject unmercifully for thirty-one minutes. His excitement fed upon itself as the chalk squeaked ever faster on the green-tinted blackboard. Blue eyes blazed behind bottle-bottom lenses as, now and again, a small slide rule was whipped from a torn shirt pocket bulging with pens, pencils, and a six-inch scale mounted on a clip. A

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scrawled chain of sigmas, deltas, numbers and integral signs grew across the chalkboard in an unkempt pattern of symbolic logic.

Managing not to interrupt, Volpone soon became absorbed.

Minutes later, his secretary popped in, saying that the budget committee was awaiting him. He told her brusquely to have Leonard Colo chair the meeting in his place, that he was not to be disturbed, then motioned for Seymour to continue.

When at last Arne Seymour fell silent, wispy blond hair bedraggled, glasses coated with a thin film of chalk dust, it was seven minutes to twelve. Alex Volpone's manner was solemn. He rose slowly, dark eyes hollow, placing a confidential hand on Seymour's frail shoulder. "I want you to say nothing of this to anyone."

"All right," agreed the physicist.

"Arne, you will have your own facilities, and will henceforth report directly to me. We'll do something about your salary, too."

"Fine. Shall I definitize my data, refine my calculations?"

"Yes, yes." Volpone waxed enthusiastic. "By all means, Arne. And please be certain to erase the chalkboard thoroughly."

Volpone returned to his desk like a sleepwalker, swiveling his chair around to examine the smog-shrouded Manhattan skyline as if searching for something. "Merciful God!" he muttered plaintively.

Then his mood changed. He began humming an operatic melody in his resonant, oddly unmusical bass. He hummed for half a bar with gusto, then launched into the opening passage of "Le Veau D'Or" from Gounod's *Faust*. His heavily wooded voice ringing in his ears, he made up in gusty volume what he lacked in tone.

At last he subsided into thoughtful silence. What an incredible idea that arrogant young snot had come up with. But was it remotely feasible?

Volpone ruminated, noting that it was lunchtime. He would have *prosciutto*, crumbly cheddar, and large, torn chunks of Anton's home-baked sourdough covered with sweet butter; some melon, perhaps, and a half-bottle of that splendid *Chianti*.

Thus fortified, he would drive home to Long Island and spend the afternoon walking about Foxhaven to mull Seymour's startling proposal. By evening he would know, deep within his innermost self, if it was merely another chimerical teaser like so many others he had run across in his career, or a tangible, attainable goal.

And whether he dared attempt it!

Alessandro Volpone laughed into his cupped fingers—a humorless, Mephistophelian laugh that hung in the seventy-two-degree, filtered air of his plush office like a vapor.

Straightening his cravat, he got

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up and confidently eased the door shut behind him.

I

December, 1987

Major Lewis Craft woke with a sense of displacement. He was definitely not in his familiar room at the bachelor officers' quarters in South Base, deep under Antarctica's ice cap.

He propped himself up on one elbow and yawned. Things immediately fell into perspective. In the subdued light, random shapes metamorphosed into the characterless, utilitarian furnishings of a seventh-floor room in downtown Washington's Statler-Hilton. He relaxed, skimming in reverse order the rapid flux of events which had brought him here: the long, dull flight from Oahu to the capital; the even longer, duller flight from Marie Byrd Land to Hawaii; the rousing send-off party at the officers' club in South Base that had made him recipient of a throbbing skull; and his surprising receipt of orders to report to General Thayer at the Pentagon.

Craft threw back the coverlet, dropping his feet to the carpet. Entirely naked, he stretched and bent to touch his toes, a compact, muscular man who stood exactly six feet tall, with a boxer's slope-shouldered stance and the slightly sway-backed, sacroiliac-lordosis condition which spelled "runner." Cadet Lew Craft had been a unanimous pick on everyone's All America Team as middle linebacker during his last two seasons at West Point. Had he been a half-step faster at falling back to cover passes, the pro scouts would have kidnapped him. A first-round selection by San Francisco's 49'ers, he'd resisted the professional football draft in favor of a career in the US Army Corps of Engineers. He occasionally regretted this decision.

Craft went to the window, pushing aside musty-smelling gold draperies. Across L Street, the Sino-Sov Coalition's somber embassy loomed next to the *Washington Post* building. He impassively studied huge Soviet and Chinese flags, hanging limp in the thin winter sunlight a half-block away where week-old patches of snow lingered in gutters, on lawns and the roofs of buildings.

Craft let the drapery fall, crossed the room, flipped on a light and went into the bathroom. Fifteen minutes later he emerged, close-cropped dark hair plastered to his high forehead, a loosely wrapped towel wound around his middle. He snapped on the TV, lighting his first cigarette of the day, and crossed one thick-calved leg over the other, smoking and watching the newscast.

Mostly, it was dull stuff. Eddy Gerhardt, the fire-breathing Midwest evangelist, had successfully rescued hundreds of souls in a gi-

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ant Christ Rally the previous evening. Soviet Ambassador Vasili Kirilov had again suddenly and mysteriously departed for Moscow on the midnight *Aeroflot* SST. Rioting had broken out afresh over Stable Population legislation, recently enacted by Congress and signed into law by President Blair, which limited offspring to 2.11 viable births per union. Craft wondered how even the most ingenious and law-abiding parents would go about having 2.11 children.

Finally a pair of items caught his full attention: a commentator's analysis of "malaise," the shortness-of-breath syndrome which had been driving indigenes of such lofty places as the Andean Plateau and Alta Himalaya ever closer to sea level, and a ribbon-cutting ceremony celebrating the opening of the Calais-Dover tube transit loop which linked the European continent, at long last, with England. Craft pushed the off-button and busied himself dressing, wishing there'd been time to have his uniform pressed. It looked like he'd slept in it, but would have to do—Pentagon generals, or no Pentagon generals.

He adjusted his tunic, squaring the engineer's castles pinned to the lapels, gave a final swipe to his shoes with a specially treated paper strip he'd found in the bathroom, and grabbed his cap and briefcase, leaving the room without a backward glance.

He checked out in the lobby, stopping for a hot-buttered roll and coffee in the grill, then made his way out into the chill of Sixteenth Street. It was cold; the breeze had a damp, penetrating edge. The notion that he, newly arrived from a frozen continent, should feel discomfort on a mild winter day in Washington struck him as absurd. Craft hailed the first cruising taxi he saw, opening the door on the fly, and vaulted in before it stopped rolling.

The electric cab drove east several blocks, turning south on Fourteenth Street, and swept past the stone hulks of Commerce and Agriculture, bore right past the Jefferson Memorial, still showing evidence of minor disfigurement suffered in last fall's progeny taxation riots, then crossed Mason Bridge into Virginia.

The driver pulled up at the Pentagon's river entrance. Craft suspiciously eyed two dozen protesters who orbited the broad walk, carrying signs and swinging their free arms to keep warm. Scowling faintly, he paid the hack, tipping less than generously.

The pickets converged. A spindly, pimple-faced kid carrying a sign advocating PEACE AT ANY PRICE! fell in step. "Hi, soljerboy! Goin' in there t'figure out better ways of *killin'* people?"

Craft maintained his leisurely gait. He was soon surrounded by sprightly fellows with mascaraed

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eyes, dressed in party-colored Renaissance tights; "old soldiers" of nineteen, wearing ragged fatigues with empty bandoliers circling their torsos; a few short-haired girls who affected no makeup and wore brightly colored women's lib buttons commanding KID ME NOT!

Craft watched the guards at the entrance as he walked, guessing they wouldn't interfere unless there was trouble. Thus far, no one had touched him.

A gentle voice at his shoulder breathed, "Let's go somewhere and have some fun, honey. You won't have any fun in *that* place."

Craft looked the kid in the eye. "You're too fem for me, Charlie," he said lightly. "I'm for leather, whips and chains, y'know?"

It got a laugh. Someone yelled, "The Gay Nineties're almost here!" And someone else called, "We'll be ready for 'em, won't we?" Which got an even bigger laugh.

Suddenly Craft's path was barred by a huge black man dressed in a leather greatcoat, a silk scarf, and jackboots. A growth of woolly hair the size of a basketball framed his solemn face. "Whoa, General," he said softly. "Give us a minute of your time, hey?" He grinned down at Craft through a drooping, evil-looking mustache. "Not uptight about me calling you 'General', are you?"

"Mercy, no," said Craft. "I am a general."

The grin disappeared. "You should complain," said the black man. "They've laid the golden oak leaves of a mere major on you."

"I'm traveling incognito." Craft stood perfectly still.

The black man chuckled. "A witticism, withal! It's obvious that you're a man of rare intelligence and wit, Major."

"I'm very witty," said Craft. "And I'm a general, remember?"

"Your pardon, General, sir," apologized the other. His manner became overbearingly sincere. "I'd like to point out," he said slowly and distinctly, "that you are a paid killer of innocents, employed by our fascistic state to do its dirtiest dirty work.

"I know—I mean I *know*—because I spent two years in the Mideast, helping pluck Israel's chestnuts out of the fire. I've seen with my own glims what napalm can do to an Arab village. I've sworn an oath to do everything in my power to convince you, and others like you, that you're nothing but paid mercenaries, employed by a warmongering, military-industrial elite who—"

"Imperialist lackey," said Craft. "You forgot to call me that."

The black man came a half-step nearer. The other protesters hung back, listening. "You are trying my patience, Major."

"Your minute is up," said Craft. "Stand aside."

The black man frowned. "Stubborn!" He waggled his index finger

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in Craft's face. "You've got to stay and rap with me, man!"

Lew Craft changed his briefcase to his other hand. When the black man reached out to stop him, he lowered his shoulder and drove forward with a lashing surge that emptied the bigger man's diaphragm, dumping him on his butt among the pickets.

Craft strolled on toward the entrance, ignoring cries of, "Fascist pig!" and "Dum-dum soldier!" The guards were suppressing pleased grins when he gravely nodded and entered the Pentagon.

Brigadier General Martin Thayer prided himself on his famous ancestor, Sylvanus Thayer, one of West Point's founding lights. To Craft, he looked much older than during their last meeting, three years before, as he acknowledged the fact that Craft was reporting as ordered by nodding toward the only other chair in his cramped cubby of an office, then resumed his writing.

At last he looked up, pushing aside a mound of paperwork. "Major Craft," he said tiredly, "I understand that you were involved in a minor fracas outside the building a few minutes ago."

"Yes, sir. Someone wanted to give me . . . a lecture."

The general's smile was bleak. "You were fortunate it ended so quickly. The news media love to cover a riot at the Pentagon. We urge all personnel to use one of the minor entrances, but you had no way of knowing that, of course. I imagine you're curious about why you were whisked away from South Base like this."

"It did surprise me, sir."

"Well it might. If your orders surprised you, the reason behind them will astound you. You were promoted just two months ago. *That*, believe it or not, is the reason. Every competent man under my command seems to reach field grade only to disappear into the Department of Transportation's maw."

"I'm . . . I don't follow that, sir," said Craft.

"Damned if I understand it myself." Thayer's headshake was bewildered. "Someone's pulling strings I've never learned the existence of, Craft. Unfortunately, you're one of the puppets.

"DoT has an awesome task on hand—riding herd on construction of the nationwide interurban tube transit system. Everyone recognizes that ITTS has Transportation overburdened, just now. Why, they can't seem to find civilian engineers smart enough to pour you-know-what out of a boot, so they raid my command for bright field-grade officers like you, and *never* give any back."

"Am I to understand that I'll be working on the ITTS project?"

"Correct, Major; the Sacramento-Reno loop that's abuilding under

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the Sierra Nevada out in California. You'll be acting as consultant to DoT, on detached service for an indefinite period. Or even longer," added the general wryly. "I allowed the first four men to go without bitching, then got up on my high horse and screamed about the fifth—letters to the Defense Department, the Joint Chiefs; more letters to Transportation Secretary Jergenson, and Undersecretary Alex Volpone. And *more* letters up through echelons, which got me only a polite 'go-to-hell' note from some bean-counter in DoT, *and* a quiet word telling me to shut up from someone who shall, I assure you, remain nameless. Never seen anything like it in thirty-two years of service!"

Craft looked intrigued. "One of my pals at South Base—a Captain Archer—was promoted late last year, and—"

"A perfect case in point," said the general, fuming. "Red Archer was number thirty-seven—something like that." The general extracted a paper from Craft's folder, examining it with unconcealed distaste. "We have another exercise to go through," he said. "A secrecy oath, Major. Yes," pursued the general acidly, "it seems your oath of commission won't hold water in the face of a *civilian* job." He let the document settle to his desktop as if it were unclean.

Major Craft skimmed it. Mostly mumbo-jumbo, it commanded his strict silence while performing DoT activities. "—such activities, and information pertinent thereto, are to be considered very highly classified, whose possession by unfriendly powers would be detrimental to the best interests of the American people, and to their common defense."

"Defense?" Craft looked up questioningly.

General Thayer grunted his disgust. "Buzzwords! Whoever wrote that thing threw in every authoritative sounding noun and verb he could glean from all of the security

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oaths ever devised. I doubt that any of it means much . . ."

The general broke off, rising stiffly. He came around the desk to stand near Craft's chair. "Lew, off the record I'm a worried man." His tone was low, confidential. "That gobbledegook is part and parcel of our nation's leadership vacuum. Oh, demagogues aplenty, but no clear-headed, decision-making *leaders* of, say, Roosevelt's or Truman's stamp. That goes for the Congress and Cabinet as well, I'm sorry to say, not to mention the military. I had occasion to visit the Academy last month; classrooms and lecture halls filled with sloppy-dressed, sloppy-minded cadets whose minds were probably occupied by girlie magazines like *Swinger*, or the fleshpots of New York, rather than partial differential equations."

Thayer sniffed his displeasure, folding his arms across his beribboned chest. "I studied your folder last night, trying to convince myself it was for the best, that DoT's need was greater than our own." He looked into Craft's eyes. "It isn't. No amount of rationalizing will make it so. In these times, when we import sixty percent of our petroleum—principally from the offshore fields in the South China Sea, right under the Sino-Sov Coalition's nose—when civilian fuel is strictly rationed and the military worries constantly about the diminishing supply, tapping Antarctica's deeply stored mineral and petroleum wealth has become essential.

"Lew," said the general, "you ranked seventh in your class—no small achievement, considering the number of hours you spent away from study because of football. More, you had the judgment and sense of duty to realize that football is only a game. I respect that."

"Thank you, sir."

"You're most welcome. But I wasn't going out of my way merely to compliment you," said Thayer. "My point is simply this: the theft of your abilities by DoT leaves a hole which is impossible to fill. Multiply that hole by the numbers of competent, skilled officers who've been snatched away to do God-knows-what, and it creates a gaping wound which may never heal completely."

General Thayer leaned close. "Something's going on—something *big*. And it's connected, somehow, with ITTS. I've chased leads right and left; chased them high and low. I've no notion what it is, or who's responsible. But stay on your toes out in California. Use your wits. The finest definition of an engineer I ever heard was, 'a qualified schemer'—someone who schemes day and night about how to do it better, more cheaply, with fewer moving parts. Be a schemer, Lew. I can't order you to violate that stupid goddam security oath, of course, but . . ." Thayer trailed off uncertainly, looking sad.

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"I'll keep my eyes and ears open, sir."

The general grinned. "I'm sure you will. Did you sign that ridiculous thing? Ah, yes. OK, it goes into your file. You're scheduled to report to the Sacramento DoT office ASAP, but I've amended your orders to include a fifteen-day delay-en-route. Your home is still in California; am I right?"

"It was kind of you to remember, sir," said Craft. "My parents are both gone, but there's . . . a girl."

"Good." Thayer looked pleased. "Well, enjoy the holidays."

"Thank you, General." Craft shook Thayer's proffered hand. "It's been a pleasure serving under your command."

"The pleasure was mine; purely mine, son."

Five hours later Craft was boredly watching the snow-drifted Nevada desert unroll sixty thousand feet beneath the great delta wing that stretched its titanium sheen outward into the stratosphere beyond his window seat.

Ordinarily, he would have studied the sunwashed immensity surrounding him and thought poetic thoughts. Today it irritated him; he wished the pilot would push the throttles to the firewall and make the aircraft march. The Lockheed SST was restricted—as were all commercial flights over the North American land mass—to subsonic cruise, thus avoiding the danger of plowing a sonic furrow across America.

Craft was thoroughly and completely fed up with flying. This cross-country junket, coming as it did hard upon the heels of his tedious journey from Antarctica, made him fidget in his narrow seat in the coach section of the half-filled bird. He'd tried to doze, then tried to interest himself in the torpid in-flight movie. He'd also attempted conversational overtures with the pert stewardess who served him tough roast beef and lukewarm coffee somewhere over the Midwest, feeling not at all surprised when she'd rebuffed him—probably because he was still in uniform. It had reminded him of the lines from Kipling that Red Archer liked to toss around after becoming adequately sloshed in the officers' club at South Base, something about, "makin' mock o' uniforms that guard you while you sleep." Or, more in line with recent events:

While it's Tommy this, an' Tommy that,
an' "Tommy, fall be'ind,"
But it's "Please to walk in front, sir," when
there's trouble in the wind—

And trouble in the wind there seemed to be. Craft had been gone from the States long enough to feel out of touch, but could not imagine a tough old bird like General Thayer running scared of shadows.

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There was a tangible feeling in the air; something more than was accountable to peace marchers, anti-birth-control rioting, or general civil strife. He had sensed it at the airport in Hawaii, in the streets of Washington, even here aboard the plane.

Restless, he walked up the aisle to the coach class lounge, rummaging through the magazine rack. Nothing caught his eye until a young, petite, rosy-skinned girl draped in a single strand of strategically placed Christmas bunting winked at him from the January issue of *Swinger*, the magazine for swingers.

Craft smiled to himself. He flipped pages to the table of contents where he found Betty Dancer's miniature, smiling likeness. Betty, the original nudie cutie in the brightly ribboned swing that *Swinger* had made as famous as *New Yorker*'s Eustace Twilley, or *Esquire*'s Eskie, had posed for the masthead shot about five years ago. He carried the magazine back to his seat and browsed.

It was the annual Christmas issue, replete with bawdy Santa Claus jokes, cartoons, and flat photos of unclothed, nubile young girls in one provocative pose or another. Youth! That was what *Swinger* was all about—the sale of youthful sexuality to young urban males who hadn't the wit to realize they already owned it.

He returned to the logo shot of Betty Dancer in the swing—the same saucy grin, flying honey-blonde hair, pert breasts, flat tummy, and long, tanned legs. Craft studied her hungrily. His memory did nip-ups and his bowels churned in sheer want.

He and Betty had been quite serious at one time. It had ended in coolness and bickering disaffiliation. Craft had promised to write, and so had she. Neither of them had quite gotten around to doing so. Her "marriage" to *Swinger* had been the primary sore spot, aggravated when Lew asked her not to pose for any more nude photos.

Craft recalled the afternoon when she had told him she now worked directly for Hoo Hanford, *Swinger*'s millionaire publisher. Their magnificent argument about his "Victorian" attitude had severed things rather permanently. But Betty was now twenty-five, or thereabouts; her days of nudie centerfolds were long in the past. What the hell! She was probably married, with one or two children, by now. Still, it wouldn't hurt to call and find out. Thoughts of Christmas alone in some dreary hotel room did not cheer him.

When the FASTEN SEAT BELTS and NO SMOKING signs lighted, he cinched his lap strap, hearing the conducted hum of servomotors as the flaps rolled backward and down, braking the SST into a nose-high landing approach attitude.

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Moments later, the tandem trucks touched down with a scorching bark, and Craft sighed. He was back where he longed to be—on the ground.

The pay phone in the boarding concourse had no video channel. Craft punched the once familiar code automatically, surprised that he still remembered it. "*Swinger* magazine," said an affected feminine voice. "Merry Christmas."

"Uh, a very Merry to you," he said. "Can I talk to Betty Dancer, please?"

"I'm sorry, sir; Mr. Hanford is not in his office this afternoon. Would you care to leave a message?"

Craft pursed his lips. "I want Betty Dancer," he said, "not Mr. Hanford. There's a big difference."

"Oh, I beg your pardon. Miss Dancer is Mr. Hanford's personal secretary, and I assumed . . . One moment, sir; I'll connect you."

"Thanks." The girl had said "Miss" Dancer.

Two clicks and a buzz later, Betty's warm contralto said, "Mr. Hanford's office."

"Hi," he said. "This's Lew."

A sharp intake of breath at the other end of the line made him visualize Betty's characteristic head toss—the little, unconscious movement that flicked her long blonde tresses out of her eyes. "Lew . . . you're home?"

"Almost. I'm at Palmdale Intercontinental. I just got in from the East, and wanted to call and see if . . ." Craft cleared his throat. "I wanted to know if we could get together while—"

"Why, I . . . I'd be delighted to see you. God, it's been such a long time. Years! How have you been?"

"Fine; real good." She sounded confused. Betty had never been an easy gal to fluster. "When," he asked, "would be a good time?"

"Lew, I . . . Right away. Now."

"Do you mean it?"

"Certainly I mean it," she said. "Take the ITTS direct loop from Palmdale to the Civic Center, then catch the urban feeder to West Los Angeles. I'll meet you at the Wilshire-La Cienega station in . . . Let's see; about twenty minutes. All right?"

One thing could be said for Betty: feminine wiles formed no major facet of her character. She rarely played cutesy female games. Betty spoke her mind, though that could be a painful thing on occasion, too. "On my way," said Craft. Then, after a short pause, he said, "Betty, I've missed you."

"I've thought about you a lot, too," she said. "Hurry!"

"Twenty minutes," he said, and hung up.

II
December, 1987

"Public acceptance, gentlemen." DoT Undersecretary Alessandro

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Volpone looked around him, waving a tiny dessert spoon for emphasis. "A decade of public use has proven the ITTS system—safe, quiet express service, adaptable to long or short haul transit. Passengers like the convenience, the absence of sway or what we call 'elevator effect'."

"It's a marvelous way to get there," agreed someone nearby.

"It certainly is." Pleased, Volpone brushed back a shock of iron-gray hair; the remark had come from a slender black gentleman known in financial circles as "Black Midas." A devotee of "sure things" by all reports, he now voted a block of shares third only to Clyde Clinton's large holdings, and to Volpone's own fifty-seven percent, which the SEC had ordered held in trust while executing his present DoT duties. But it was Clinton who craved wary walking. Lying in the weeds all through dinner, Clinton had been awaiting the opportunity to attack.

And his chance was coming. A covert glance at his wafer-thin atomic-electric wrist chronometer showed that Volpone's sixteen guests, now almost finished with dessert, would soon forgather in the lounge for brandy and cigars—sixteen wealthy, influential men and women who would have him and Leonard Colo at the mercy of their calculating, rehearsed questions for an hour or so of agony.

Volpone wiped moist palms on the napkin in his lap. His father had instituted the ceremonial wining and dining of principal shareholders prior to CompAirCorp's third annual stockholders meeting in the late Thirties. "It soothes them," his father had counseled, "making them less liable to attack your policies head-on from the floor when it matters." Volpone could remember when the dinner had been pleasurable. Even ten years ago, when the conspiracy in which he was deeply embroiled had been less of a nightmare, he'd actually looked forward to describing corporate programs which never failed to earn bountiful dividends. Each subsequent dinner had been worse. Someday his incredible juggling act—borrowing from Peter to pay Paul—would come to light. There was no way to fend it off.

"I surely enjoy the tube," said a lumberman hoarsely. "Ride from Seattle to Spokane an' back every day, I do. Just like sittin' on a soft, downy cloud, but I have trouble believin' the darned thing's goin' five hundred miles an hour."

"I find it incredible myself," said Volpone. "Perhaps we're becoming spoiled, taking ITTS for granted."

Muttered exclamations of assent traveled around the near end of the table. From the corner of his eye, Volpone saw Clinton look his way, something steely and unforgiving in his glance, and sensed it time to launch his warm-up speech. "Ladies and gentlemen," he began, "if

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we review the history of land travel, salient milestones become clearly pinpointed. Early wheeled vehicles allowed the building of towns and cities far from waterways or the seas. Then horse-drawn conveyances came along, enabling town dwellers to live in the rural countryside and work in the city; farmers could market produce in high-paying population centers. There's an adage: 'When it's time to railroad, railroads will be built.' Technology evolved machine-driven vehicles—automobiles and trains—creating a mobile society, encouraging westward expansion in America.

"But this 'progress' brought along a series of curses: pollution of the air we breathe, the water we drink; noise, congestion, deterioration in cities marking the treasurehouses of our culture."

Volpone paused, gauging their attention. "You're politicking," accused a voice. "Two years ago, when you were only a board chairman, your speech had more snap, even if it was the same speech."

Clinton's casual remark stirred a ripple of laughter. Volpone forced a grin. "I had much more time to rehearse it two years ago. Seriously," he continued, "ITTS's rationale is inescapable. When we first proposed building compressors for the earlier, less sophisticated prototype in the late Sixties, we were struck by the logic behind DoT's trade-off studies.

"Consider a twenty-five by fifteen foot elliptical bore—a true pendulum arc—reaching thousands of feet underground, blending into controlled involute approaches tangent to the surface at either terminus. The same question always cropped up: What would be the astronomical cost of such geometrically accurate bores? DoT's systems engineers looked at it from an overall systems standpoint, as a *gestalt* problem. Their answer was amazing: the cost-effectiveness of sending nuclear-powered boring rigs through the Earth's crust proved far superior station-to-station to any other high-speed systems solution—between four and five million dollars per mile for a totally completed and equipped tunnel.

"There were no rights-of-way to buy, no eminent domain payoffs, no easements to declare, nor would there be the history of surface property devaluation traditionally created by unsightly, noisy surface rail lines.

"The boring vehicles—ultimately designed for inertial guidance—were developed by one of the oil tool companies: atomic borers, fusing rock at the ferocious pace of twelve feet per hour, while tungsten-carbide bits chewed a neat ellipse. Ergo, the tunneling problem was solved."

"Then came this maglev business," remarked the lumberman.

"Magnetic levitation," said Vol-

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pone, nodding. "Guidance and train suspension are achieved by bipolar repulsion, without the concomitant energy losses normally induced by rolling wheel friction, or wheel flange roller-bearing friction. Maglev is drag-free—excepting minor eddy current generation, plus minute drag from the power wipers themselves."

"It sounds ingenious," ventured Black Midas. "We ride on magnetic currents, and are propelled by air."

"Exactly." Volpone warmed to his task. "Our compressors operate on a continuous duty-cycle, evacuating the side-by-side tubes to an average underpressure of 2.1 psi, allowing high pressure-low pressure differentials behind and ahead of the train respectively—the 'blow gun' principle. Squirts of quick demand, high pressure air are released in fractions of a second by means of computer-operated ports spaced along the casing walls. The beauty of this is that no propulsive energy device need be carried aboard the trains themselves, making each assemblage of cars a lightweight shell.

"There are secondary virtues," he went on. "Aerodynamic drag effects and turbulence are greatly reduced in a semi-vacuum, hence the high velocities attained. And the underground system is relatively maintenance-free—complete environmental protection, with subsequently reduced corrosion in ferrous parts."

"How about safety?" asked a gaunt, elderly woman across the table. "The notion of rushing along blindly makes me nervous."

"Ah, but you aren't rushing along 'blindly', madam," corrected Volpone. "Each ten feet of casing is strain gauge monitored at a central station. Every pneumatic valve, power distribution point, wiper section, and compressor station is visually monitored on closed-circuit TV.

"None of the unexpected hazards common to conventional carriers can occur: no traffic crossings, bridge washouts, snowdrifts covering the rails. Complete electropneumatic failure would cause your train to stop smoothly on its skids as the tube fills with air from automatically opened ports—a sort of 'deadman switch'—though that's never happened. Emergency lights will come on; a supply of compressed air, plus backup thruster bottles, will propel your train to the nearest emergency elevator shaft. You'll still be home in time for dinner."

"Well . . ." The lumberman waxed his hands reflectively. "All I know is it gets me from my front door to the office in about two hoots an' a handshake. We take ITTS for granted, nowadays."

There was a concerted scraping of chairs. "Thank you, Mr. Volpone," said Black Midas. "It was an absorbing account."

"It was my pleasure, sir."

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Clinton was waiting to pounce, lighting a cigar and pretending to listen to what was being said around him. He dropped his eyes when Volpone herded Black Midas into the lounge.

Alex Volpone squared himself mentally, deciding it was better to get it over with. He confidently approached the group surrounding Clinton. "Gentlemen, did you enjoy yourselves at dinner?"

"First rate . . . excellent . . . very nice." The muttered politenesses diminished. Clinton's sulky baritone cut the air like a scalpel. "We should have enjoyed it; it cost us enough!"

"You've heard discouraging rumors, Mr. Clinton?" asked Volpone.

"It's easy to guess what the dividend will amount to—peanuts!"

"I'm afraid you're correct. The quarterly dividend will again be quite moderate," admitted Volpone in a strained voice.

"I thought so." Clinton's lips compressed unforgivingly.

"I realize how disappointing that must sound." Volpone lighted a cigarette, studying the smoke. "The dividend will not be significantly larger than the last quarterly. Blame diversification, the plowing of profits back into expenditures for tools and materials. Our assets have increased five-fold in the past twenty months: new earth-moving equipment, conveyor systems, derricks, barges and tugs. And we have, I must remind you, ventured into deep ocean mining, cement and glass manufacture, hydroponic farming. We have spent millions on research, and pioneering is always expensive."

"But," objected Black Midas, "is growth our only prospect?"

"You mustn't forget our large, continuing expenditures for ITTS air reduction equipment, either." said Volpone, trying not to sound defensive despite oppressive odds. "When progress payments from DoT begin to roll in—"

"Growth is too *fast*," insisted Clinton with heat, "too damned single-minded! I know you've stepped away to help Jergenson at DoT, but the fact remains: you should be home minding the store."

Volpone rocked on his heels, smoking with outward calmness. "Gentlemen, we've undertaken a job projected to last another fifteen years—building a network of ITTS tubes linking population centers throughout the contiguous United States, Alaska, and Hawaii. We've now purchased, or constructed, all tools necessary to complete that job. The payoff is on the not-too-distant horizon. I ask your patience; VI's backlog and potential profits are absolutely fantastic."

"Fantastic, eh?" Clinton ground out his cigar. "OK, let's see you field this one: I've had reports of continuing excavation on or near sites purportedly completed six

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months ago. Why, Volpone? Aren't we meeting schedules?"

"A half-truth, Mr. Clinton." Volpone's deep voice was steady. "The scope of the job—which I admit appears peculiar—was altered slightly after the contracts were let. We'll soon receive a nice cost renegotiation fee on the enlarged portion of—"

"Enlarged?" Clinton's eyes narrowed. "What's enlarged?"

"I . . . didn't mean in size," Volpone hurried to say. "Let's call it an expansion of performance criteria; rework will require supplemental electronic and electrical modifications that—"

"Strange," said Black Midas. "Why would 'electronic' modifications require additional excavation?"

"Damned right it's strange!" chimed Clinton. "You don't 'excavate' electronic mods. Care to clarify that, Volpone?"

The industrialist cleared his throat determinedly. "The answer is a technical one. I'm not prepared to answer such questions at this time, but I do want to say—"

"I'll bet you're not!" Clinton thrust his jaw forward in vexation. "Two evasions out of two; you're batting one thousand. Let's take one more, just in the interests of science: Why is VI running so phenomenally high on long-term interest payments?"

"It's because," said Volpone immediately, "we've borrowed so heavily against phenomenally high long-term potential profits."

Clinton looked as if he'd bitten into a wormy apple. "But the goddam loans are pushing three *billions,* Volpone. The interest-plus-principal payments are staggering, yet your price-to-earnings-ratio is still fifty-to-one. That makes absolute nonsense!"

"I've explained the backlog of work, our accumulation of assets,

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the impending cost-plus-incentive-fee progress payments."

Clinton was furious. "Two-bit quarterlies on an eighty dollar stock!" he said, the color high in his cheeks. "Damned poor management! You've squandered time, labor, profits. Why, it's so obvious . . . if some dumb-ass buyers would come into the market and turn the price around just a little, I'd dump the whole rotten mess!"

Volpone sadly bowed his leonine head. "I can't believe you're serious, Mr. Clinton. You've got land, buildings, equipment that's operating, earning a great deal of money daily. VI is solvent. You shareholders have earned a gigantic equity, and for you to—"

Alessandro Volpone found himself addressing the back of Clinton's swiftly retreating thousand-dollar suit.

Afterward, alone with Leonard Colo in the rear seat of the speeding limousine, he felt only all-encompassing weariness. The dinner had been a fiasco. Clinton had eaten him alive, not forgetting to spit out the skin and seeds. He closed burning eyes; the nightmare question rose to haunt him—a specter foretelling future troubles. "You don't suppose that cobra knows, do you?"

"No," said Colo. "He has no way of finding out."

Volpone sighed. "You reassure me. What would I do without you?"

"You would probably go to jail," said Leonard Colo.

Volpone chuckled tiredly. "A peaceful jail cell sounds delightful, just now," he said. "Lord, if Clinton and the others discovered that my shares—supposedly held in trust while I'm acting for DoT—are mortgaged to the hilt, they'd trample us like a herd of elephants. I would lose Volpone Industries."

"Nonsense!"

"It isn't nonsense. I'd be forced to resign and reclaim my shares if it ever came to a proxy battle. You and I both know how impossible that is. Everything would come to light—everything."

"Yes, you know it," said Colo, "and I know it. But Clinton and the others don't know it. I spent months and months mortgaging your securities. Only our . . . good friends invested."

"Invested!" Volpone's bass was laden with self-reproach. "I have wheedled, cajoled, begged, lied and cheated. I wonder how understanding our 'good friends' will be? They've thrown their money behind a worthy cause, true. But few of them will ever learn of it."

"As have you, so you tell me," reminded Colo.

Volpone's shrug was eloquent. "I'm dry—almost completely dry. But not sorry. I would do it again, in exactly the same way."

"I would shoot you first," said Colo.

Volpone snickered. "Leonard, the

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world political situation makes me thank everlasting God—and Arne Seymour—for the opportunity to *do* something concrete before it became too late."

"World politics today is precisely what it has been for the past five thousand years," said Colo dryly. "You'll discover sympathy for destitute billionaires to be rather a scarce commodity, Alex. Especially for one who's been convicted and sentenced on fifty or more counts of willful conspiracy to defraud."

"Oh, you're scoffing and cynical, Leonard. I would rather be imprisoned by a free society for flouting its laws than enslaved, or vaporized in the coming holocaust, by its enemies."

"I beg you; no patriotic speeches," pleaded Colo. "I'm too old, too tired for flag waving. I have watched you—*helped* you—dissipate an enormous fortune. Not through drink, gambling, or in any of the classic ways, but in pursuit of a madman's dream."

"A very competent madman," modified Volpone.

"A madman, nevertheless, who advocates building expensive compressors and gargantuan air storage tanks in untold quantities at ruinous cost for ever and ever and ever . . ."

"You're exaggerating. Remember, your madman's dream is shared by myself and four of America's most powerful men. Our present dilemma was created by people problems, not by hardware. Had Senator Stillworth been less ambitious, or Secretary Jergenson less obstinate in the matter of the Federal auto license proposal—"

"Whatever, Alex; whatever!" Colo waved his hands in frustration. "You must have your nose rubbed in it, eh? Very well. I'm in a position to know your personal finances. You will soon have trouble meeting your daily household expenses. What about that?"

"True." Volpone looked very dubious, very subdued. "Nearly everything is in the pot. Did I tell you I'm thinking of selling the yacht? Why should I be burdened with a yacht?"

"Because you love the yacht," answered Colo sourly.

"Aa-a-agh! I haven't set foot aboard the *Spindrift* since last year's Bermuda cruise with Marissa. There are a few hundred thou—perhaps even a million—in the yacht, and quite a few millions more tucked safely away in Switzerland."

"Switzerland?" Colo sounded surprised. "So, you've begun to keep things from me. No matter; I'm damned glad you have it. You badly need a cash buffer."

"Most of it will go for debt interest; I want the collateral returned on my securities. Proceeds from sale of the *Spindrift* will keep Foxhaven going another four or five years."

Leonard Colo turned slowly.

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"And after these five years?"

"Afterward, if there is an after, we'll find a way to cross that bridge. Please; I don't feel up to an argument tonight."

"As you will." The accountant lapsed into moody silence.

Absorbed in watching the lights of Flushing hurtle past across the less and less used Long Island Expressway, Volpone made a request. "Leonard, remind me to buy Marissa a Christmas present."

"Certainly," rasped Colo. "I'll even lend you the money."

Transportation Undersecretary Volpone guffawed, slapping his financial manager's knee in delight. "Leonard, you're ageless. You never change," he said as the quiet-running electric limousine raced on into the night.

III

December, 1987

Major Lew Craft rode a descending ramp into the long, spacious main concourse of Palmdale Intercontinental Airport's ITTS station. He found a lavender-colored ticket kiosk labeled *Los Angeles Civic Center*, and dropped his credit card into a slot. The ticketing machine spat out the plastic card wrapped in a lavender ticket.

Another slideway carried him three levels downward. He stepped off into a correlated lavender branch vestibule—an artificially skylighted gallery containing rest rooms, benches, trees, and planters filled with bright-hued perennials. The lavender ticket admitted him through a floor-to-ceiling turnstile which gave onto the boarding concourse.

Craft inspected everything with renewed interest, admiring the conscientious effort to keep all functional equipment completely out of sight. He had not used ITTS for nearly two years; the fact that he would soon be employed at a similar installation made him aware of the nicety of furnishing, the appealing detail design, that had gone into this one. Nothing warned of an arriving train until a series of doors opened simultaneously in a hitherto muraled wall, exposing row upon row of the two-hundred-compartment train's eight-passenger compartments, only ten of which were visible in this segment of the boarding concourse. Had these eighty seats been filled, he could have either hunted through other segments, or simply waited for another train. There were many vacant seats; the ITTS trains ran seven minutes apart—*exactly*.

He stepped across the flush threshold, choosing an unoccupied seat. The entire eight-passenger module had automatically swung to a horizontal attitude when the inbound train reached the crest of its involute approach, running straight and level into Palmdale Station. The seats were deeply contoured, covered in glove-soft vinyl, with

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double armrests and semi-wrap-around headrests. His body triggered a pressure-sensitive switch; soft stereo music emanated from the headrest wings inches from either ear.

Seconds later, an attention-commanding buzz warned of imminent departure; an inner diaphragm began drawing closed across the ovoid doorway. When no boarding or disembarking passenger interrupted the closing membrane, its sections joined, activating an interlock switch; relays closed along the train's length, and the computer commanded all hermetic doors to roll down and seal. There was a sibilant hiss of air, then silence. He could hear only a muted whisper from the air conditioning.

Mild acceleration pressed Craft gently into the seat, easing off after perhaps ten seconds, followed by no sensation of movement whatsoever. The train, accelerating down the involute section of tube, caused the compartment to cant unobtrusively, maintaining an attitude which kept the seat of his pants aligned with the axis of acceleration. But that acceleration was regulated computerwise to coincide with the gravitational nulling effect of falling down the tube's descending pendulum arc. Deceleration at the far terminus would work in precisely the opposite way.

Craft knew the southern California network to be crisscrossed with many geologic faults and fracture zones: the Pacific Coast's earthquake belt, a portion of the "ring of fire" girdling the Earth. As well as lesser known crustal fractures, the Mojave-Los Angeles trunk line penetrated the renowned San Andreas Fault, which had been excavated to form a large chamber filled with dampening material—no mean engineering feat in itself—hopefully permitting enough compliance, or elasticity in the casing-fault interface, to prevent tragedy in the event of a major quake.

Craft could have watched a newscast, or selected a minutes-old financial computer readout. Had this been a long haul interurban train, he would have had time to read a magazine, order a drink, or watch prerecorded entertainment.

Not very many minutes later, the seat of his pants told him mild deceleration forces were at work. Deceleration abated, then ceased. When the compartment door opened, he was exactly fifty-five kilometers as the crow flies from Palmdale Airport.

He did not ride all the way up to main concourse level in Los Angeles, pausing at a three-dimensional model of the entire complex to select one of the many suburban feeder lines color-coded to the city's southwest quadrant. This time it was a vermilion kiosk. His vermilion ticket allowed him to board a commuter-jammed train. He stepped out minutes later at the

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Wilshire-La Cienega station, seventeen minutes after leaving Palmdale.

This time he stayed on the slideway, emerging into the main concourse lying directly beneath Wilshire Boulevard's pedestrian esplanade, where clusters of tall palms and subtropical foliage were illuminated by translucent skylights set dramatically in the swooping planes and curves of a high, free-form ceiling. Craft let the broad central slideway carry him toward the far end of the mile-long concourse, watching the signs. He got off at the foot of an ascending ramp labeled *La Cienega Drive.*

He hefted his briefcase impatiently and searched the crowd, his uniform earning more than one casual glance from passers-by. But Betty was nowhere in sight. He was excited by the prospect of seeing her again.

Then he glanced upward and spotted her; there was a small catch in his throat as he watched her enter the descending ramp above him. Craft ran lithely up the downward moving ramp against the grain, causing pedestrians to dodge nervously out of his way. Betty Dancer's eyes widened; she started to say something, but he caught her in his arms and swung her around, then simply held her until the ramp carried them down and deposited them at concourse level.

Betty ignored the many stares. "I've been swept off my feet before," she said breathlessly, "but not like *that.*"

"You never wrote to me."

"Well, neither did you." Betty disengaged herself.

"I . . . wanted to." Craft guided her toward the ascending ramp. "I meant to write; tried to write. I didn't because . . ."

"I'm not married, if that's what's worrying you." Betty smiled. "Marriage is . . . Marriage is obsolete."

"Marriage," he said, "will be obsolete when people are obsolete, which may be sooner than we think."

Betty caught her breath. "Oak leaves—you're a major now!"

"Just an accident," he said. "Betty, you look smashing."

"But older," she said ruefully. "Does it show?"

Lew Craft made no rejoinder, leering at her as they rode the slideway leading to the parking strip. He didn't kiss her until they were seated side-by-side in Betty's tiny electric runabout. She pushed him away after the second long kiss.

"Oh-h-h! High voltage, Major. I do like, but no encores. We have to get going; I'm taking you to a super Christmas party."

Craft stroked her hair. "You can go to Christmas parties any time at all," he said.

"Never out of season," she pointed out. "It just isn't done. Besides, Mr. Hanford needs me. And he's the boss."

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Craft kissed her again. "I need you, and I'm the boss."

"You're a male chauvinist . . ." She ran her finger along the line of his jaw. "Sorry; Mr. Hanford's still the boss, Lew."

"Let Mr. Hanford find his own Sheila," he said softly.

"Sheila?" Betty was intrigued. "Wherever did you learn that?"

"Um, I spent a month's leave in Australia and New Zealand last fall, if you must know."

"It sounds vulgar." She wrinkled her nose. "I'll bet only chippies are called 'Sheilas'."

"Negative. It's a term of endearment." Craft kissed her again.

"Oh-h-h!" Betty pushed herself away resolutely. "You stroll home and I leap into your arms . . ." She looked into his eyes for a dreamy instant, then impatiently flicked back her hair and turned the key, energizing the little runabout.

Betty wheeled rapidly to the surface and drove west on Wilshire, saying not a word until they turned into the underground garage beneath her high-rise Westwood Village apartment.

"Welcome home, Lew," she said in a tender voice.

It was after midnight when the runabout finally rolled up a limousine-jammed drive high in the Hollywood Hills. Publisher Hoo Hanford's palatial mansion looked like a random set of glass boxes piled atop one another high above the San Fernando Valley's lights. Craft studied the *moderne*, stylized Christmas tree blazing on the rolling lawn. He made a rude noise with his lips, a thumbs-down gesture. Betty smiled and squeezed his hand. Inside, the party was in full swing—even for swingers.

Betty let him circulate while she hunted up her boss to apologize for being AWOL. Craft surrounded a double Scotch and felt more in the spirit of things despite his weird getup. Betty had stopped somewhere in the vast Wilshire District shopping maze, where no one ever slept, persuading him to buy something more suitable for a party than his uniform. Still sated with the smell of her hair, the smooth warmth of her skin, he hadn't felt inclined to argue, picking out what he thought was a ghastly formal lounging tunic replete with spangles and a frilly collar, bright orange form-fitting tights—declining the codpiece a salesman insisted went with them—and shiny, tasseled pumps. Five minutes on the terrace, where two dozen guests floundered drunkenly in the pool under a high bubble cover, convinced him that he was the most conservatively dressed man at the affair.

At least ten Santa Claus characters wandered about, Ho-ho-hoing! and ringing bells, having a helluva time pinching Hanford's squads of Swingerettes, who wore next to nothing and wore it well, buoyed

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up in front by tiny uplift bras that clung magically to the underside of each breast. Deeply curved, abbreviated wisps of shimmering fabric accentuated the inner thigh line, making even the dumpiest girl look leggy and svelte. Above him, a nude Swingerette floated back and forth in a jazzy, ribboned swing.

Many nominally male guests wore Renaissance tights, now in vogue, Craft noticed; others favored the ruffled sleeves and starched collars of Beau Brummell. Not a few of the younger women wore sheer body stockings—with nothing but sheer woman underneath.

Beginning to enjoy himself, Craft was searching for a waiter when a petite Oriental Swingerette accosted him. "Major Craft?"

Craft leaned close, saying, "We've got to stop meeting like this."

The girl giggled. "Miss Dancer asked me to find you and invite you into the study. Please, will you follow me?"

"Anywhere!"

The Swingerette giggled again, leading him, bouncing and jiggling pleasantly, around clusters of laughing, drinking guests on the terrace. It was quieter indoors; they threaded their way across the stark, cavernous simplicity of the living room, and turned down a carpeted hall. The Swingerette knocked politely, standing aside.

Conversation broke off. Hoo Hanford excused himself and came forward, one hand outstretched. "Craft; good to have you back."

"Great to see you again, Mr. Hanford."

"Hoo. By all means, call me Hoo."

A ruggedly-built, graying man seated on the sofa next to a demure looking woman grinned a boyish grin. "You're hooting like a barn owl, old-timer," he complained. "Bring Betty's fella in here so we can get a look at him."

Hanford took the pipe from his jaw, looking vaguely amused. Then he put it back again. "Major Craft," he said around the pipe, "I'd like you to meet Virginia and Victor Lewellyn. Senator Lewellyn loves to put me down. I let him get away with it because he's bigger than me. Besides, Vic's our guest of honor tonight."

The senator laughed good-naturedly, rising to shake hands. "My pleasure, Craft. Betty just finished telling us you're newly arrived from the South Pole. Come fill your glass; she'll be back."

"Nice to meet you both," said Craft. "Scotch; no ice, please," he told Hanford, giving him his glass. "I, uh, didn't get quite to the Pole," he confessed. "South Base lies under the Whitmore Mountains in Marie Byrd Land, about five hundred miles from the Pole."

"Of course—South *Base.*" Lewellyn regarded Hanford, genial torment in his grin. "You blew it,

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old-timer; South Base houses an experimental Earth resources project."

"Naturally." Hanford was nonplussed. "We ran an article about South Base not long ago. Happen to see it, Craft?"

Lew Craft looked sheepish. "I, no . . . I can't seem to get past the pretty . . . pictures in *Swinger,*" he said.

Lewellyn and his wife both roared with laughter. "Your readership speaks," gibed the senator. "Give up articles and stories, Hoo; concentrate on more nekkid fillies."

Hanford rattled the pipe against his teeth, making a point of ignoring Lewellyn. "What's the main target at South Base, Lew?"

Craft sipped his Scotch. "Mostly petroleum, of course, though diamonds and anthracite coal were found back in the Sixties. The ice cap—about seven billion cubic miles of it—weighs down Antarctica with tremendous pressure, depressing the underlying land mass below sea level in places, South Base is slant drilling experimentally in spots where there're only a few thousand feet of ice. In some places, the ice cap is fourteen thousand feet thick."

"Whew! Sounds expensive," said Hanford. "*Very* expensive."

"Waiting until more accessible fields run dry might prove even more costly, now that we've lost the Mideast supply."

Senator Lewellyn set down his glass. "Hell, everything's expensive! As a member of the Senate Finance Committee, I can tell you there's not one government agency or bureau which isn't drowning in red ink just now. There's some justification for heavy military spending, what with the Sino-Sov Coalition's saber rattling, but the real villains are State and Transportation. State spends billions on foreign aid, while DoT has the transit project on its hands. And ITTS really costs a fantastic amount."

"I'll be joining the ITTS program next month," said Craft.

"You will?" The senator looked at Craft with new interest. "In what capacity, if I'm not too inquisitive?"

"As a consultant," informed Craft. "My specialty is heavy equipment—earth-movers, nuclear boring rigs, that sort of thing. I've been assigned to the Sacramento-Reno loop that's . . ."

Craft broke off as the door opened. Betty Dancer popped in, carrying a sprig of mistletoe. She held it over Craft's head, pecking him on the cheek. "Merry Christmas, Major mine. Did you meet the Lewellyns?"

"Sure did," said Craft.

"Aren't they dolls?" Betty took his arm. "Let's go join the party, what say? Maybe you'll be lucky and win a goodie, Lew."

"A . . . goodie?" asked Craft, perplexed.

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Hanford nodded affably. "We're about to kick off the third annual *Swinger* olympics; it's been a popular feature of our Christmas parties—sack racing, three-legged racing, bobbing for apples, and so on. It may sound corny, but it's fun."

"Just like an Iowa pumpkin doins'," said Betty. "Wait till you see all those super-sophisticated swingers tossing a raw egg back and forth, stepping away from each other until it breaks in someone's hand." She opened the door. "Come on, all; a party needs its guest of honor."

Smiling, Hoo Hanford got up to follow them. "Stay a minute," called Senator Lewellyn. He waited until he was sure Betty and the major were beyond earshot. "How well do you know this Craft?" he asked earnestly.

"Oh, we met occasionally when he and Betty were running around together," said Hanford. "Why?"

"I've been looking for him—for someone like him—for quite some time." Lewellyn became very serious. "Do you suppose Betty will agree to get the major to do some snooping for us?"

Hanford scratched behind one ear. "Probably. I imagine Betty could make Craft roll over and bay at the moon if she wanted to. But, why, Vic? He's just an Army engineer."

"He's an *inside* man," corrected Lewellyn, looking pleased with himself, "or will be when he reports to ITTS. You wouldn't believe the smokescreen someone's thrown around the inner workings of ITTS, Hoo. That project literally eats like an elephant, and defecates like a flea. I hate mysteries. When the Senate Finance Committee can't find out what's causing the money drain, I worry."

Hanford fiddled with his pipe, developing a faraway look. "Couldn't you subpoena enough principals to find out?" he asked.

"Oh, we've tried. Alex Volpone, who's a good front man for Jergenson in DoT, testified some time ago, then took us on a personally conducted tour—inside the guts of the Washington-Baltimore loop, not just for a ride on the train. He impressed everyone with his expertise, but we learned nothing new. After separating out the obfuscations and drivel obtained in other hearings, little remained but a morass of technical reasons for overexpenditure."

"Hm-m-m, I may assign one or two of *Swinger*'s bird dogs to it," mused Hanford, sounding interested. "Maybe there's a story."

The senator made an annoyed grimace. "Hoo, if your staff included Dick Tracy and Sherlock Holmes you still wouldn't get a story," he said matter-of-factly. "That's if Dick and Sherlock didn't turn up missing afterward. A half-dozen private shamuses, two Naval Intelligence agents, and five or six

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Justice Department investigators have dropped from sight while sleuthing around ITTS."

"Don't be too sure, Vic; we have a handful of good men. Remember that story on Volpone I showed you?"

"Volpone makes fascinating copy," said Lewellyn, "but a character study of Alessandro Volpone has nothing to do with finding out why ITTS gobbles dollars like an open rat hole."

Hanford shrugged. "What makes you think Craft could find out?"

"Because he's an *inside* man," repeated Lewellyn, "a professional military officer who's above suspicion. I think Craft's a good bet; he doesn't say much, but he seems pretty darned bright."

"OK, I'll see what I can do, Vic. I'll talk to Betty."

"Major Craft looks familiar," mentioned Virginia Lewellyn.

"You may have remembered *Swinger*'s All-America Team pictorial spread around '78 or '79," said Hanford. "He was a standout linebacker at West Point."

"You mean *he's* the fellow who turned down a pot of football gold to stay in the Army?" asked Lewellyn. "Hell, I remember him now, too. Better and better, Hoo; see what Betty says about it."

"I'll sic Betty on him," promised Hanford. "C'mon; let's party."

Senator Lewellyn took his wife's hand. "Maybe another sprig of mistletoe's hanging somewhere, eh, Ginny? Could you stand a Christmas kiss from the old man?"

Virginia Lewellyn made a wry face. "I'll spend the whole night shooing Swingerettes away from you," she said resignedly.

"Deck them halls!" cried the senator happily.

IV
January, 1988

"Michigan Bluff," remarked Arne Seymour, his breath steaming in the cold. "Not much of a place this time of year, is it?"

"It sounds rather like a card game," said Alessandro Volpone idly. "Is that the name of the small town we flew over?"

"Michigan Bluff," assured Seymour. "California's Gold Rush began in a crossroads called Coloma about twenty miles over that ridge. We're exactly half way between Sacramento and Reno." Seymour peeled down the cuff of his mitten, glancing at his watch. "Where the hell is he, Alex?"

"Patience. He'll be along directly." Volpone lifted his face toward leaden skies hanging over the lightly forested, snow-clad Sierra Nevada foothills. "Parkinson is fetching him from the Sacramento Airport. They probably ran into snow flurries."

Seymour puffed his cheeks, doing a little jig to warm himself. "I'm sure there'll be snow here later today," he said.

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Both men wheeled toward a diesel growl above them as another seventy-ton bite of fused and pulverized rock started its seven-mile downhill trip toward the middle fork of the American River where the rail spur terminated. The newly cut rock would be taken to an automated Sacramento Valley plant producing both cement and glass needed to build the many ITTS stations proliferating up and down the Pacific slope. The monster earth-mover crawled past them down the macadam road at a stately five miles per hour; on the flank of its huge bucket was stenciled a blue-and-silver foxhead device encircled by the legend *Volpone Industries*. Alessandro Volpone's multibillion-dollar corporation had installed the gargantuan elevator which hauled slag and pulverized rock topside from steadily-burning boring rigs burrowing through solid granite more than a full mile beneath their feet.

"They're nibbling away down there," mused Seymour, chafing his cheeks with mittened hands. "I imagine the air storage complex is almost finished. I want to look over—"

"Your mouth, Arne!" Volpone grabbed the other's arm, exerting sudden, hurtful pressure. "Watch what you say, here in the open."

The physicist winced. "Hell, no one's within a half-mile of us!"

"That's absurd. Modern eavesdropping techniques are extraordinary. Last week I was shown a prototype laser windowpane pickoff device capable of modulating the vibrations induced in a pane of glass by low-level human speech. Clear, ungarbled reception, Arne."

Seymour flexed his arm gingerly. "But we aren't under glass."

"Aa-a-agh!" Dark eyes clouded with anger, Volpone whirled to stare up at the mountains. "You're impossible! Someone on that ridge could read your lips with low-power binoculars. Several people know I am here; several thousand would like to learn why."

"You're getting paranoid, Alex." Seymour rubbed his arm. "Why *are* we here, by the way? Why chase around to these . . . sites, talking to every new engineer the Army sends us?"

"Habit, my loose-mouthed friend. Thus far, personal acquaintance with high level strangers on the project has paid off handsomely."

Seymour shrugged. "Parkinson works for us, doesn't he? You didn't bother interviewing him."

Volpone had a gleam in his eye. "There's a difference. Parkinson is actually one of Emmerson's men, though nominally on our payroll."

"CIA?" Seymour looked thoughtful.

"Of course. But, in addition to that . . ." Volpone regarded the physicist more as an object than a person. "Psychology is not your

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forte, Arne. Why not admit it."

"OK, I admit it. So what?"

"So I like to think that it is *mine.*" Volpone scowled. "Put yourself in the place of this engineer. He was torn from another assignment, directed to report here by some superior who resented the theft of his talents. Our new engineer may be disgruntled, perhaps annoyed at having his love life disrupted. What will make him feel more important, more needed, than a personally conducted tour of the Sacramento-Reno . . . er, tunnel, by a Cabinet official?"

Seymour's pale eyes twinkled. "You almost said—"

"Be silent! We both know what I almost said. You make me wish I'd left you in New York to play with your slide rule."

Seymour giggled. "I like to watch you turn on the old oil, Alex. Here comes your chance." Seymour pointed to the lowering sky.

The copter, a ghostly black teardrop, flirted momentarily with the overcast's fringes, then popped down into clear air, thrashing overhead in a wide arc to descend a thousand yards away in the meadow beside the road. Two men jumped down, jogging heads-lowered beyond the rotary wing's sweep. The copter's fuselage was decaled in the familiar blue-and-silver foxhead logo.

Volpone studied the approaching men from afar. CIA Agent Parkinson, supposedly a new Volpone Industries employee, was adept at playing the role of a likable, "hard hat" superintendent. The engineer accompanying him looked sturdy, capable of handling himself. Volpone had been pleased by the performances of the forty men whom he had caused to be spirited away from the Army. They had proven diligent and trustworthy—with several notable exceptions.

"Arne, let's meet at the shaft head in about two hours," said the industrialist, making it a subtle directive.

"Right, Alex." Glad of the opportunity to get in out of the cold, Seymour turned and trudged toward the crest of the hill.

Alessandro Volpone strolled a few dozen paces down the road. "Ho, Parky," he hailed. "Have a good flight?"

"Right nice, Mr. Volpone," called the laconic Parkinson. "This here's Major Lewis Craft. I told him you were visiting us."

As they exchanged amenities, Volpone looked the younger man over. Craft's bearing indicated strength of character, as did his firm handshake, establishing a rapport both men sensed immediately. Volpone spun the customary tale—his chance presence while on an inspection tour of ITTS facilities. Then Craft briefly related his recent duties in Antarctica.

At the first opportunity, Parkinson interrupted. "Pardon me, Mr. Volpone. Think I'll hop an empty

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and ride back down below."

"Certainly, Parky." Volpone waved him away, smiling. "Thank you for meeting Major Craft. I appreciate your trouble."

"Nothin' to it, Mr. Volpone. See you later, Craft."

"Well, would you like some coffee, Craft?" asked Volpone. "We can talk for a bit, then go below in the dig and look around together."

"Sounds great, Mr. Volpone."

"Wonderful! Let's round up that coffee, then." Volpone led the way up the road, his easy gait belying his years.

The elevator had been designed to lift seventy tons of fused, powdered rock; passengers were negligible, incidental cargo. Volpone and Craft entered a small six-passenger operator's cab that perched on the rim of the gigantic bucket like a teacup balanced giddily on the lip of a double boiler.

"Standardization," commented Volpone, noting Craft's interest. "The computers decided long ago that seventy tons was an optimum bite, both for raising and cartage. A boring rig's nuclear torch and tungsten-carbide bits fuse and grind two hundred tons of reduced rock in little more than one hour, so there's ample logistics time to run a single bucket to the surface and back."

Craft gasped despite himself as the floor fell away beneath his feet. Empty, the carrier dropped with disconcerting swiftness. He grinned. "It's fun, when you get used to it."

The huge elevator dropped steadily for minutes. Then subtle, ever-increasing pressure made their knees tend to buckle as the cab came to a smooth stop. Volpone had taken a transistor-radio-shaped device from an inner coat pocket and was holding it near the double doors while pressing a stud with his forefinger. The doors rolled open, exposing a second set of heavy steel doors.

"We couldn't be at bore level yet," said Craft uncertainly.

"You're observant," commended Volpone. "This point is only about seven-tenths of the way down to bore level."

The main doors rumbled open. Craft tensed, finding himself looking into the muzzles of a pair of submachine guns held by two sleepy-eyed United States Marines.

"Conestoga," said Volpone in a quiet voice. The nearer marine brought his weapon smartly to port arms; the other maintained his watch on Craft. "This is Major Craft," said Volpone, affixing a green-striped badge to his lapel. "He is reporting today. Mr. Parkinson will see that he's issued a badge and formally briefed later in the day. I'll vouch for his presence now."

"Yes, sir," said the black Pfc. "Thumbprint, please, Major; sign your full name, rank, AGO number, and date of commission."

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After they had satisfied the marine guards, Volpone led the mystified Craft along a narrow granite passage disfigured by a sea of jackhammer scores, turning right at the intersection of a longer, broader tunnel lighted by crudely strung construction lamps. As they walked, the distant growl of heavy equipment grew louder. The temperature was comfortable; Craft doffed his coat.

Alex Volpone showed the major into an alcove hollowed from living rock. He closed the door and snapped on a light. "Over here, Craft. I'm sure your curiosity has been whetted by this cloak and dagger business which, I assure you, is quite necessary." Volpone drew back a rude curtain from a large picture window, stepping aside to let Craft look his fill.

The chamber dwarfed the great hall at Carlsbad Caverns many times over. Arc lights set in the vaulted ceiling stretched almost to the vanishing point, illuminating the jumble of machinery, workmen, and equipment scattered across the vast floor. Squat, tracked vehicles carried crushed rock to a point beneath the window and disappeared from view; hundreds of workmen were busily erecting frame structures, preparing precast masonry walls, installing piping, slideways, paving. Along the side wall, rows of potted shrubs and trees waited to be set out.

Lew Craft turned to regard the

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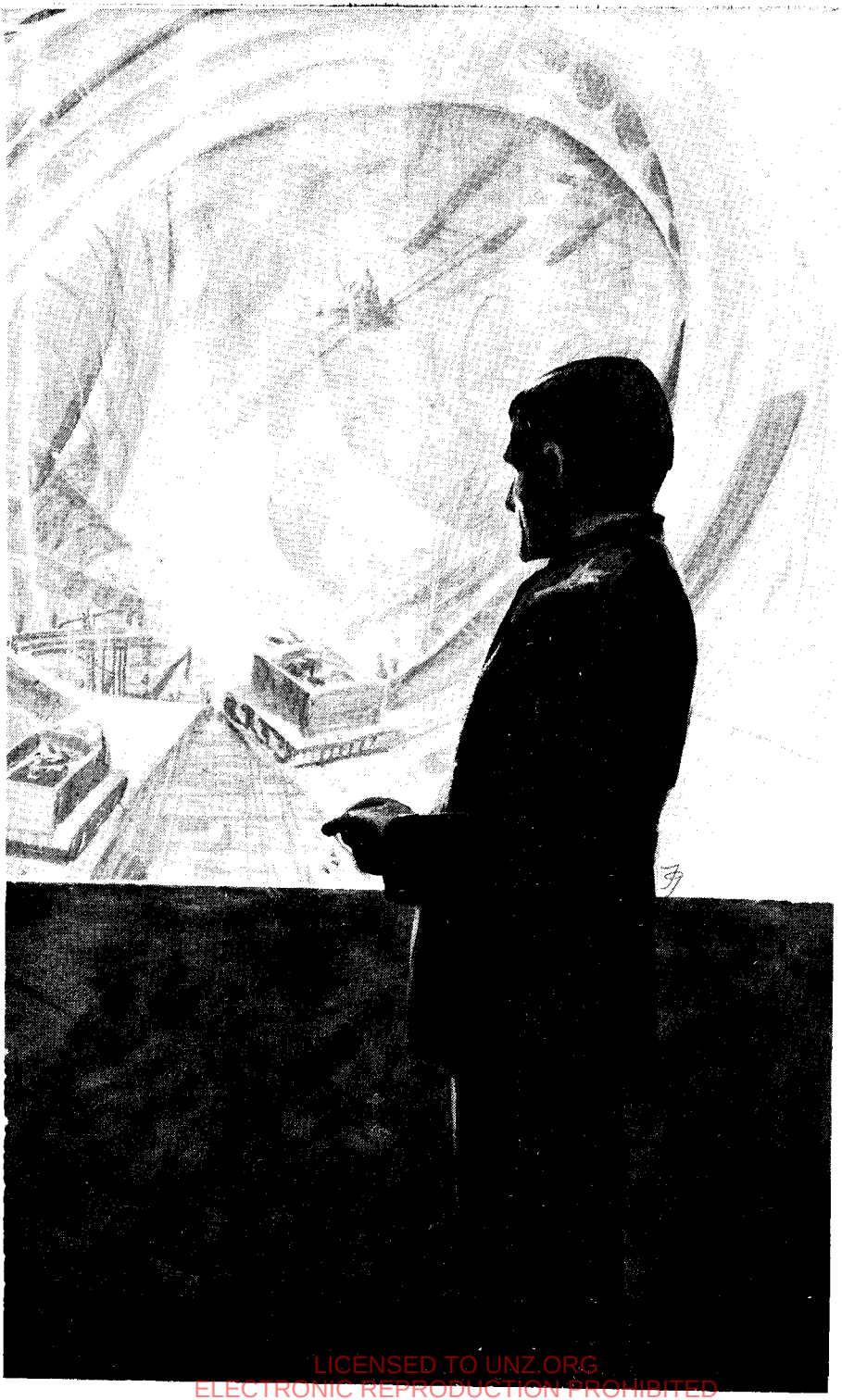

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industrialist quizzically. Outwardly nonplussed, his eyes were bright with curiosity. "I give up, Mr. Volpone. What is it?"

"A city, Major Craft." Volpone's smile was paternal. "We are standing above D Level—what might be termed the central square. There are three levels above us, and eight below." He hitched a battered wooden chair around to face Craft. "As a professional military officer," he began, "you are cognizant of the enormous strides Communism has taken in recent years. World War Two lent impetus to the USSR's territorial ambitions; practically all of Eastern Europe fell under Marxist sway, followed by the Cold War, and Korea.

"But the Reds had only begun. Cuba and Chile fell to them; Vietnam toppled slowly, propped up for a time by American lives. Then Cambodia, Laos, Thailand; the bloody Philippine Revolution reversed the political polarity of a traditionally West-oriented society. The USSR even managed to bring Yugoslavia back into mainstream Communism after Tito's passing. Then Peru, Ecuador; many South American nations are now teetering, deciding which light to follow."

Craft himself was teetering back and forth in his chair. "You're telling me they're winning. Is that it?"

"They *are* winning." Volpone was doubly emphatic. "A sober, proven fact which is obvious to even the most naïve geopolitical philosopher. A fact, unfortunately, which at least five US administrations have refused to face. Until the passing of Mao Tse-tung, we were confronted with only the Soviet menace. China remained an enigma, accusing the USSR of revisionist Marxist doctrine, engaging in endless border disputes with her neighbor. But after the Common Market signatories banded together to form the United European Nations, Russia made hasty unity overtures; Chinese and Russian differences vanished, if *authentic* differences ever existed. Joining in a common front against the Western democracies was cheaper for both the USSR and China."

Volpone paused, marshaling his thoughts. "Major Craft, an extrapolation of the curve plotting Communist gains since Cold War days points clearly to an approaching climacteric. A decisive confrontation seems unavoidable. The Sino-Sov Coalition, and their satellites, form an awesome, monolithic power bloc. They've successfully subverted other nations, and made serious inroads upon yet others—including the United States, I'm sorry to say.

"Being chief signatory to the SEATO alliance forced us into a hopeless, untenable battle we could not hope to win in Vietnam. But that was merely a dress rehearsal for the Mideast War, which found the Arab world calculatingly armed

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and funded to mount a holy crusade against tiny, fiercely independent Israel. Israel survived—barely. But Islam fell under the Sino-Soviet thrall in the end."

Volpone waxed his hands. "Major," he said slowly, "the National Security Council believes the world balanced on the brink of cataclysm. We don't have twenty years; we'll be damned fortunate to have twenty *months*."

Craft's eyes were slitted. "And we're digging in, preparing?"

"Precisely." Volpone's nod was sober. "The National Redoubt under construction around us is being forwarded on a crash priority basis—a round-the-clock effort to provide safe haven for a representative sampling of our populace. People from every walk of life will be chosen, invited to move to California or Nevada, as nearby the complex as is practicable."

"Chosen . . . by whom?" asked Craft.

"Final selection will amount to a lottery, really. Numerous candidates have already been screened and nominated. Those ultimately picked will be taken from the lists by computer—unique qualifications, age, family status, lifetime accomplishments, and availability being the prominent criteria. Archives will be kept in the redoubt's lowermost area—M Level. The entire contents of institutions like the Library of Congress, plus still photographs, moving pictures, corporate business records, banking and financial records, and so on, will be stored on microfilm."

"How many people will the complex sustain?" asked Craft.

"Between seventeen and twenty-five thousand."

Craft looked startled. "*That* many? For how long?"

Volpone smiled grimly. "Prepare yourself for a shock. They'll be able to remain underground approximately twenty-five years."

"Jesus H. Christ!" said Major Craft.

Alex Volpone looked pleased. "Now you begin to see why we had you pulled away from Antarctica; why I came all the way out here in order to talk to you personally. It's a *gigantic* enterprise. I must try with every iota of persuasive power I possess to impress upon you the scalding importance of what we are doing here."

"I . . . it seems unreal," said Craft.

"It is a waking nightmare," said Volpone. "But we felt a moral obligation to save at least something, win or lose."

"That's . . . reasonable," said Craft with less than complete assurance. "Mother of God! How do you propose to store consumables for more than twenty thousand people *that* long?"

"It isn't necessary," Volpone explained. "You see, the National Redoubt lies adjacent to the chord-

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line run of the Reno-Sacramento ITTS loop. Think what that means: easy access from either the Nevada side, or California; a believable cover story for thousands of workmen and engineers purportedly engaged in ITTS construction; a secret, isolated site, interdicted from thermonuclear attack by thousands of yards of solid, overlying granite. Our chief boons are all spinoffs from ITTS. My corporation manufactures compressor equipment. Guessing what other purpose those compressors are used for shouldn't be difficult."

Craft shrugged. "Storing air," he said. "Or oxygen, if you take the trouble separating it out."

Volpone clapped his hands. "You've confirmed my first impression of you, Craft. No, we don't bother isolating oxygen; not with Earth's entire ocean of air at hand. We'll store enough air within eighteen months—clean, filtered, smogless air. Likewise water. The Sierra snowpack will be adequate, assuming we're allowed this winter, and next, before . . . the climax. Air-driven turbines will provide wattage to throw away, backed up by an emergency nuclear power station. Tell me; does it begin to make sense?"

"I . . . yes. It's pretty far out," said Craft, shaking his head. "I want to think about it for a while. How about food?"

"Food is no problem, compared to the thirty-four mass-pounds of air each person will require per day. A six months' supply of indispensable staples will be stocked. Another of VI's diversified product lines is hydroponic farming equipment. The techniques are established; our 'tenants' will grow their own food, raise stock animals and fowl . . ."

A light tap on the door caused Volpone to call, "Yes?"

One of the marines who had admitted them to the redoubt thrust his head in far enough to say, "Phone for you, sir." He pointed to the squawkbox on the wall with the snout of his submachine gun. "You can take it here, if you want."

"Thank you." Volpone rose stiffly. "Excuse me, Craft. This should only take a minute." He switched on the intercom. "Volpone."

"Stand-by for voice check, sir," crackled the speaker.

In a sing-song bass, Volpone chanted, "Mary had a little lamb; its fleece was white as snow. Maryhadalittlelamb."

He waited. Presently, the squawkbox erupted. "Thursday night at eleven o'clock." There was a faint click. The line went dead.

Volpone turned, glancing at his watch. He eyed Craft speculatively, his manner suddenly distant. "I must apologize for this," he said. "I'd intended for us to have dinner together and continue our discussion. Now, I'm afraid that's impossible.

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"Why don't you wander around for a bit, Major, and get acquainted? Your temporary badge will admit you almost anywhere within the complex. When you're ready, have the marines at the portal call down for Parkinson. Parky will see you to your quarters."

"I think I will, Mr. Volpone," said Craft. "It was really a kick meeting you like this and, uh, thanks."

"The privilege was mine, Craft. I'm sure we can count on you." Volpone held out his hand, beaming. "Good-bye."

After the Undersecretary of Transportation closed the door, Craft went to stand before the window, pondering the movement of men and machines far below him. He seemed entranced.

"The Hall of the Mountain King," he muttered under his breath.

Then he frowned. Today was Wednesday, January eighteenth. He speculated about what sort of person might be able to summon a big wheel like Alessandro Volpone with a single, cryptic phone call, for he recognized a summons when he heard one.

He thought about it for a time, then dismissed it with a shrug.

V

January, 1988

"I wish you didn't have to go out." The lovely, raven-haired girl pouted, petulance in her voice. "You've been away three days, Alex. I'd so looked forward to our being together tonight."

Volpone touched her hand. "Business, Marissa. I've no choice."

The limousine drew alongside the curb on Adams Drive. The central Washington ITTS station had been built under The Mall, offset slightly so that near-surface arrival and departure tubes would avoid sub-basement levels of the Capitol, as well as the Washington Monument's underpinnings. It was thirteen minutes to eleven when Volpone kissed the girl and got out.

"Will I see you tomorrow?" she asked in an injured tone.

"I'll call." Volpone smiled reassuringly, still holding her hand. "We'll go to dinner—perhaps see a show."

"Good night," she said, turning away.

Volpone watched the limousine out of sight, then sighed and hurried to the descending ramp. He did not buy a ticket, making his way through the turnstile by virtue of an electromagnetically keyed DoT pass card which he dipped briefly into the ticket slot. The yellow slideway carried him to a boarding concourse labeled *Central Baltimore,* whose decor was also yellow.

Volpone quickly checked all ten visible cabs when the first arriving train's row of doors flashed open. Few people got off; one or more

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individuals still occupied every compartment. He sauntered to another segment of the boarding concourse, found a vacant eight-passenger cab, and entered, activating the device he'd used to gain admittance to the California redoubt. The safety shells and outer door of his particular compartment closed immediately.

He relaxed through the first gentle surge of acceleration, then tugged out a collapsible spike antenna from the electronic keyer and depressed a second stud, watchfully studying the lucent passenger information display. Suddenly the message read: AN UNSCHEDULED ONE MINUTE STOP WILL BE MADE FOR MAINTENANCE PURPOSES. PLEASE REMAIN SEATED.

Volpone waited patiently until much heavier than normal deceleration pressed him deeply into the seat. He braced himself as the cab rocked to a horizontal position, watching the door.

When diaphragm seals expanded to allow pressurization in the adjacent tube, the outer doors separated vertically. He bolted from the compartment, holding the keyer chest-high in front of him. This aspect of entering the sanctuary always frayed his nerves. One whole minute was allotted for entrance, true; and should something go amiss there was always the opportunity of jumping back aboard the train before the tube diaphragms relaxed, the door sealed, and most breathable air whooshed away. Nevertheless, thoughts of stumbling, perhaps dropping the keyer, made him doubly careful.

Pressures equalized; the steel-sheathed portal opened. Volpone entered the redoubt with forty-two seconds to spare, sorting over in his mind the week's passwords. "Pick-axe," he said in his resonant bass, clipping on the green-striped badge.

"Yes, sir." The marines lowered their weapons, ushering him briskly to an elevator marked *Authorized Personnel Only.* He used the keyer to command the elevator's doors to dilate, gripping the handrail as the floor fell away beneath his feet. He emerged into a stark corridor more than six thousand feet beneath Laurel, Maryland.

Three men were waiting when the sanctuary's door opened. Senator Raymond Stillworth, shaggy-maned and florid-faced, conversed quietly with his alter ego, United Television Network board chairman Nathanial Abrams. Dr. Rolfe Emmerson, who had been CIA Director under two preceding administrations, made coffee with saturnine concentration.

"Gentlemen." Volpone drew out a chair, settling himself.

"General Patt'll be late," drawled Stillworth, regarding Volpone with the innocent, vacuous grin that masked a mind capable of cutting through side issues and non-germane detail like a rip saw. "The

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President called a fire drill at the White House, Alex. Patt'll be along directly. How're you keepin'?"

"Not too badly, Ray," admitted Volpone. "I was notified of the meeting out in California yesterday. Who ordered it?"

"Me." Nat Abrams held one finger aloft in the manner of a toddler asking permission to go to the bathroom. "The money situation's still rotten as hell, Alex. I thought we needed a powwow."

"I see. Did you manage to squelch that magazine article, Nat?"

"Not yet," said Abrams. "I'm going to squeeze Hanford, the publisher, slowly. He'll come around; leave it to me."

Abrams then launched into a dissertation on money and its uses which utterly bored Volpone. The TV boss, a pipsqueak promoter at heart, had not the slightest knowledge or "feel" for making money work to best advantage. Volpone found him repellent, disliking him in a casual, someday-we'll-do-something-about-him way. Volpone lighted a cigarette and listened with half an ear.

He was lighting his second cigarette, ten minutes later, when USAF Lieutenant General Michael Patt strode through the opening doorway and set his briefcase beside the table. "Good evening."

"How y'all, General?" Senator Stillworth leaned back, pudgy hands clasped across his ample belly. "Nathanial here was goin' over the dreadful lack of capital we're experiencin' right now. Lordy, our little project surely does spend a potful!"

"You'd better bring me up to speed," said Patt in a monotone.

Volpone liked the general every bit as much as he disliked Abrams. Ramrod straight, Michael Patt was all of sixty; he looked a robust forty-five, exuding that undefinable air of command Volpone knew was impossible to counterfeit. Despite his lack of a fourth star, Patt generaled the Strategic Air Command and acted as chairman of the Joint Chiefs of Staff.

"In a nutshell," said Abrams eagerly, "we've milked every cow in the barn twice-over. We've still got the shorts. Unless new money shows up, we'll have to hold the line right where we are."

"Just where are we, as of today?" asked the general.

Four pairs of eyes swung expectantly toward Volpone. "There are 3,250 districts in operation," he said from memory, "with a thousand compressor sites in each district—3,005 sites offshore; the remainder land-based. Call it 3.25 million compressors."

"Which means?" asked Stillworth, squinting.

"Every twenty-four hours, about 7.02 times 10^{12} mass-pounds of compressed air is—"

"Alex, for Chrissakes cut out the gibberish!" Stillworth wagged his

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head in frustration. "What's that mean in English?"

Volpone regarded Stillworth narrowly. "Every day, we store some 3.5 billion mass-tons of compressed air," he said clearly and distinctly, "less the minute fraction ITTS uses."

"It sounds a helluva lot!" Stillworth scratched his shoulder. "Don't suppose it amounts to a sizable dent, though."

"Except at higher altitudes, no," said Volpone. "We have a long pull before the effects become noticeable at sea level."

"None of us'll live that long," said Stillworth wistfully.

"Aren't we tracking our major milestones almost exactly?" inquired Patt. "Maybe it only seems to be moving slowly, Ray. My chief concern is that Sino-Sov agents may penetrate our activities before they can become effective. Have there been any red flags in your department, Rolfe?"

Emmerson cleared his throat, setting his coffee cup slowly and deliberately in the saucer. "There's been no hint of penetration by foreign agents to date," he said in a thoughtful manner. "Our people in China and the USSR have watched closely for signs of a security break. The ITTS cover story would seem to be working nicely for Lifeboat. As for Project Luft, our supposed oceanic radioactive waste disposal cover tends to shy people away. More, who is going to trot about measuring air intake at the various sites? Frankly, I'm much more concerned with keeping Army and Naval Intelligence, and the FBI, off our necks."

A debate began at once. General Patt took a stand in favor of toughing it out along the lines of the "game plan" laid down more than thirteen years before, whereupon the senator made a lamentable pun about "standing pat," contending that hastening Luft's fruition in some manner was the only viable alternative to building more compressors and storage tanks.

Rolfe Emmerson listened carefully, contributing nothing. Volpone decided to stay out of it himself, since Patt needed little help. He studied the senator covertly. The Senate Majority Leader's incisive, country-boy drawl made him sound like some low-pressure auto salesman. It hadn't always been so, Volpone reminded himself. In the past decade Raymond Stillworth had changed radically. Volpone remembered their lengthy conversations in times past, debating the responsibility of government to business, and vice versa, and the tacky, long-gestating progeny taxation measure. Ray Stillworth had once been known as "Old Fog-cutter" on Capitol Hill—a noble sobriquet for a legislator of the old school; a southern knight who dueled with rhetoric rather than pistols, but in a fashion every bit as deadly.

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Now Stillworth was aging; his former ruddy glow had given way to the broken-venuled complexion of a tippler, and his patient, career-long search for a path to the White House had transformed itself into a pell-mell dash toward political power at any price. Volpone had reason to believe that Stillworth now nursed dictatorial ambitions through his covert leadership of the ultra-right-wing American Rangers, which no one was supposed to know about.

Volpone had first been introduced to the barrelchested, silver-tongued senator at a party following the 1972 national convention, drawing him aside with showered compliments and explaining who he was. He clearly recalled Stillworth's exact words: "Oh, ho! So you're one of the fellas who're buildin' those fancy underground tube trains."

They'd gotten drunk together, Stillworth and Alessandro Volpone, getting along famously. Sometime during the evening, he'd invited the senator to weekend at his Long Island estate.

Working in his office the following Thursday, Volpone had received a call from Stillworth's secretary. The senator could be picked up at La Guardia on Saturday morning, if that was convenient. Volpone would have none of it, insisting upon sending his personal jet to Washington to collect him. Cordially greeting Stillworth when the plane landed, the drive out to Foxhaven had formed a good beginning. Stillworth had not said as much, but Volpone sensed that he was thoroughly impressed by the welcome.

All day Saturday—golfing, dining, lounging about the estate—had been wasted motion so far as Volpone's purposes were concerned. But by late Sunday morning the senator had begun to let down his hair, his true feelings about the nation's future sounding dour indeed. A student of history, Stillworth had delved into the traditional evolution of Western cultures: frontier society to agrarian society, followed by a crude republic, then a short-lived democracy which degenerated into revolution and eventual dictatorship. He felt America was traveling the same rutted course, providing Volpone with excellent ammunition.

Their views on the threat posed by Communist territorial ambitions had dovetailed precisely. Alone on the terrace for sundowners, he'd taken a deep breath and told Raymond Stillworth of the grandiose programs he'd undertaken, remembering his numbness while awaiting the man's reaction.

Stillworth had roared with laughter. "You're gonna do *what*?"

It had taken the rest of their time together to convince him it wasn't a joke. At the airport, just before the senator emplaned, they'd

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shaken hands. "It surely does intrigue me, Alex. Sounded like a screwball notion when you first told me, but I do begin to see possibilities. Call me next week an' we'll talk some more."

Five months and eleven days later, working together in a hard-sell, soft-sell tandem, they had solicited CIA Chief Agent Rolfe Emmerson, and Emmerson had paved the way for recruiting then-Brigadier General Michael Patt. But Stillworth, and Stillworth alone, had recruited Nat Abrams, saying "We got a military big wheel, an industrial tycoon, a government windbag, an' a super-spy. What we need bad is a media boss. Then we got 'em surrounded."

Surround 'em they had! In less than sixteen months the first redoubt came off the drawing boards, construction starting in late fall of 1973—this very complex, paralleling the Baltimore-Washington ITTS bore, the first-built segment of the Northeast Corridor Network linking all major population centers from the nation's capital to Boston.

And Raymond Stillworth had provided the primary impetus, had been the driving force behind Project Lifeboat, as the redoubt system was known, in the early days.

"Well, Alex?" Eyes bulging, the senator was staring at him.

"Pardon me," said Volpone. "I wasn't paying attention, Ray."

"Money, Alex," said Nat Abrams. "We've been racking our skulls, trying to come up with new sources of revenue. It's that, or live with what we've got for a few months—years—then go like the hammers of hell later to catch up."

"Luft? There can be no such thing as 'catching up'," rumbled Volpone. "I thought I made that clear. Luft works exactly like mortgage amortization. When you begin paying off a fully amortized loan, most money goes toward paying the interest. Gradually the principal curve steepens; during the last years, almost all of the payment is applied toward repaying the principal. Our timetable calls for expansion on an ever-slackening, but steady, never-ceasing scale. The frantic building pace we paid for so dearly in the beginning will earn tremendous dividends, but the 'principal' curve is still practically flat. We *must* maintain our projected manufacture schedule for both compressors and pressure vessels, or the base we've labored so long to create will be meaningless."

"Hell's fire! None of us'll live to see those 'dividends'."

"We knew that when we began, Ray," said General Patt, irritated. "We weren't thinking entirely of ourselves, were we?"

Swelling with anger, the senator started to frame a retort. He thought better of it and subsided. "OK, if any more tanks an' com-

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pressors get built, we gotta figure out a way t'pay for 'em. How about it?"

Abrams, awaiting his chance to regain stage center, said, "Alex, I've been running down the list of public revenues. We're mutually agreed; our private resources have completely dried up." Abrams gave a nervous laugh. "Unless you have a few bucks tucked away somewhere . . ."

Alessandro Volpone scowled. "I have sufficient personal funds to meet household expenses for another year or two," he said sternly. "I'll be happy to bring in statements and invite each of you to match my contributions dollar-for-dollar."

Stillworth wheezed with laughter, throwing back his head and clapping his hands with glee. Abrams barked appreciatively, while the general merely chuckled. Even Rolfe Emmerson smiled sadly.

"That's kind of you, Alex," gasped the senator. "A *billionaire*, invitin' us peasants to pony up an' match the pot with him!"

"An *ex*-billionaire," corrected Volpone. "But I've purchased something the entire gross national product couldn't buy today. I've helped create an irreversible advantage over conniving vermin who are cold-bloodedly planning our extinction. When the evil day comes, what will *money* be worth?"

It was quiet in the sanctuary for five seconds. Then General Patt said, "Let's go over that list again, Abrams."

"Sure." Abrams leafed through his papers. "We've never tapped Federal income, or sales taxes, or tried. Too many people and too many agencies are involved. We catch a dribble from public land rentals—parks, and so on—and a little more from faculty taxes."

"Which's that one?" demanded Stillworth.

"The rated earnings tax on a person's trade or profession. We've also hit social payroll levies—social security, unemployment, health insurance—though that was a damned hard nut to crack. The senator opened some doors for us there."

"The *crooked* senator," smirked Stillworth.

"Then we come to the gravy," continued Abrams. "Commodity tariffs, and consumption taxes—the value added tax on manufacturing, packaging, and distributing goods—have done us the most good."

"Not forgetting the hundreds of millions we've siphoned from DoT's legitimate budget over the years," reminded Volpone.

"Uh . . . sure; DoT," conceded Abrams. "All in all, the new progeny taxation should eventually provide the greatest source of public revenue in sight. What the hell; we set it up! But it isn't being felt, nor will it be for a long time. People are really up in arms; thoughts of paying for the privilege of having chil—"

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"The goddam Stable Population Bill short-circuited it, anyhow." Stillworth glanced around the table, daring anyone to refute him. "First we make 'em pay to have kids, then tell 'em they cain't have but two even if they can afford it. Dammit, to me that don't make a whole helluva lot of sense!"

When no one offered a comment, General Patt asked, "What new programs are in the offing?"

"Citizenship tax," said Abrams, "protection tax—fire and police support levies—and the Federal auto license fees."

"Y'might get the protection thing passed, what with riots an' long-haired scum meanderin' about the streets," said Stillworth impatiently, "but that 'citizenship' tax won't fly. Letters would fill my office to the rafters if my constituents had to pay somethin' called a citizenship tax." He looked questioningly at Volpone. "Federal auto licensin' was your peanut, wasn't it?"

Sourly, Volpone assured him that it was. "Secretary Jergenson showed me the door last week when I broached the subject again," he told them. "He refuses to let his name be used as an endorsement, though I've done everything but get down on my hands and knees and beg."

"Uh-huh. Win some, lose some," philosophized Stillworth, inspecting the rock ceiling with a faraway expression. "Goose egg," he said. "Anybody got any bright ideas?"

It had turned into a rather glum gathering. Volpone looked from Emmerson to the general, from Abrams to Stillworth. "I have some friends," he said cautiously, "who might be persuaded to invest."

"Friends?" Stillworth's bloodshot eyes narrowed. "Seems to me we've kicked that melon around before, Alex."

"We have," admitted Volpone, "but never realistically."

The senator snickered. "Your 'friends'," he said in a scornful voice, "may be the last bastion of American democracy, eh?"

General Patt looked perturbed. "Gangsters, Alex?"

"Businessmen," corrected Volpone. "You're thinking of the old days, General. Some of America's most prominent families were established by slave traders, robber barons, pirates. My friends do have a similar heritage, but for many years they've been only businessmen, I assure you."

"Crazy goddam notion!" Stillworth rudely banged his fist on the table. "I propose puttin' it to a vote, an' good riddance."

"After all, you did ask for suggestions," pointed out Volpone. "As always, majority rules. Shall we vote?"

"One moment, Alex," cautioned Rolfe Emmerson. "Will you have to give them full knowledge of our affairs?"

"Yes," said Volpone. "No fish story would sway them, I'm sure."

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"But do you—*can* you—trust them?"

Alex Volpone smiled disarmingly. "I can and do, though it's not easy to explain why. You have to know them as . . . I do."

"Well, hooray! That surely is a convincin' argument." Stillworth banged the table again. "I say we vote, dammit. A show of hands; all in favor of lettin' Mr. Volpone put our necks in the wringer by sharin' our little secrets with his 'friends'?"

Volpone lifted his hand casually, watching Emmerson. The CIA Director's features were placid, but the conflict in his eyes was plain. Rolfe Emmerson eventually raised his arm.

Which made Patt's the deciding vote. Predictably, Abrams and Stillworth formed a common front. Disgusted, Volpone was about to lower his hand when the general reluctantly lifted his.

Stillworth was astounded. "I cain't imagine you're serious!"

"We've got to continue building tanks and compressors," said Patt in a low voice. "Money is a *must*—from anywhere."

"But . . . from the goddam *Mafia?*"

"From anywhere," insisted Patt. "The end justifies—"

"You're pullin' my laig!" Stillworth cried. He shook his head angrily. "Well, I been beat before, an' I'm gonna get beat again in the future, but . . . you gentlemen surely do surprise me."

"You'll find it's for the best," placated Volpone. "Unless I'm mistaken, we can count on a very significant contribution."

Volpone felt the senator's burning eyes upon him. "Let's all pray you're *not* mistaken, Mr. Volpone," Stillworth drawled.

With a scraping of chairs, the meeting began to break up.

VI
February, 1988

A tarred road led from the main highway to a three-story rock gatehouse. An old man wearing an officer's billed cap came out slowly to examine the silent electric limousine with rheumy disinterest. He lifted the locking pin and rolled the wrought-iron gate aside, saluting gravely as the car squeezed through.

Under the tires, crushed pink stone made a whispering reminder of the wealth required to own and maintain such an expanse of private land. The drive wound for more than a mile beneath a row of maples standing bare-limbed and stark against the buttermilk winter sky, paralleled by a spotless white rail fence. Beyond the fence were stretches of open meadowland where horses and cattle grazed in the summertime.

The drive ended in a cobbled court partially covered by a porte cochere entrance. Patinaed by age, though scrupulously kept, a Geor-

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gian mansion built entirely of fieldstone looked down through diamond-paned windows. Five or six wide stone steps led to a fifteen-foot-high arched doorway where the butler waited.

The stocky, unsmiling driver held the limousine's door for his elderly passenger, whom the butler showed into a lofty vestibule containing giant mirrors, statuary, and floored in terrazzo. Beyond the vestibule, a cathedral-like parlor offered mahogany-paneled doors recessed in classic alcoves of carved stone. Monstrous chandeliers depended from a domed ceiling above twin balconies and the travertine chimney piece of a huge fireplace.

Alessandro Volpone descended the stair in a weary lope. "Vito," he called, beaming, "you look well. *Very* well."

"For an old man," temporized Vito Vico, inspecting Volpone with candor. "You, on the other hand, seem very tired."

Volpone's laugh boomed through Foxhaven, sounding a trifle forced. "Come; let's go into the library. We'll have some of that Madeira you prize so and renew acquaintances."

Don Vito Vico, *Capo Mafioso* of the largest "family" on the Eastern Seaboard, was not primarily known for his tact. "You said that our meeting was important, Alessandro. Business first?"

Crestfallen, Volpone watched the Don warm his hands before the blazing fire. Drawing out a hundred-millimeter cigarette, Vico inserted it carefully into an ivory holder with palsied hands. Volpone hurried to bend and snap his lighter, saying, "Vito, I'm in trouble. I'm forced to beg for help—a great deal of help."

"*Salud!*" The Don smiled sadly, holding his wineglass aloft; trouble was an ancient, well-known adversary. "What are friends for but to help one another? And, the nature of your . . . trouble?"

Volpone sipped his wine. "Money," he said unsteadily.

Vico's craggy features remained expressionless; his lips pursed in a silent whistle. "I find that surprising," he said. "For many years you have owned a large, prosperous corporation—"

"Which is deeply mortgaged."

"I'm aware of that. We were amazed when Leonard Colo came to us with the proposal to mortgage your holdings. I've no doubt that it was necessary, but . . . all right; you need money. What shall we expect in return, Alessandro?"

"Call it a guarantee that business will continue to prosper. Without money from you, I can't . . . be sure."

"Protection?" Vico's lip curled in amusement.

Volpone chuckled tiredly. "That sounded absurd, I know. Forgive me. You're right; I'm very tired this evening."

"Take your time; explain the sit-

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uation slowly. You remind me of your father the night he came to us pleading for money with which to begin a new business venture he had in mind."

"My . . . father?" Volpone looked surprised.

The Don nodded. "It was 1934—the height of what people call the Great Depression. Many were without jobs."

"My father included," said Volpone. "He mentioned it often."

"Your father included," agreed the Don. "He had been unemployed nearly two whole years; no one was hiring engineers in those days. He told us of an itch to put a radical new air compressor design on the market. We tried to persuade him it was the wrong time, the wrong financial climate, but he was right; we were wrong."

"Compressed Air Corporation!"

Vito Vico brightened with pleasure. "Knowing him, I'm not surprised that he never told you. We were paid back handsomely for our faith in your father. He was an honorable man, Alessandro." The Don looked up at Volpone with a satisfied expression. "And you are your father's son."

"Thank you, Vito; I'll try to live up to that." Volpone took to pacing the carpeting, hands behind his back. He suddenly went to the hand-carved double doors of the library, glanced briefly into the hall, then closed and locked the doors. He came back to Vico, pulling an armchair around to face him squarely. "I must tell you something in strictest confidence, Vito. It must not pass beyond these walls."

Vico's brows lifted. "You would pledge *me* to secrecy?"

"Even you, Vito." Volpone leaned forward. "I *must.*"

"Walls sometimes overhear things," warned Vico.

"Not these. Foxhaven is one place I'm absolutely sure of."

Vico stubbed out his cigarette, laying the ivory holder to one side. "I'll keep your counsel, Alessandro. *Omérta.*"

Volpone began his dissertation by tolling Communist gains since World War Two, being extremely well-versed through having lectured over forty Army engineers. Vico listened without discernible emotion, extracting another cigarette after a time. Volpone lighted it for him, then resumed his narrative.

"Let me be certain that I understand you," said the Don at last. "You, and this group of other important individuals, have taken it upon yourselves to safeguard the US from attack *forever?*"

"Um, it's much more involved than that," said Volpone. "We've adopted both long- and short-term plans; Project Lifeboat to counteract the threat of thermonuclear attack, and the other to gain an ever-increasing advantage, over a period of many generations, which our enemies cannot hope to equal. Every passing hour gives us further

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advantage. We hope to develop Project Luft into—"

"Luft?" questioned the Don.

"The German word for air," explained Volpone. "Luft will become a club in the hands of generations yet to come."

Don Vito Vico sighed. "Hearing that from a lesser man, Alessandro, I would leave this house and never enter it again. Why haven't you approached the authorities with your schemes?"

"We tried twice with Lifeboat," said Volpone. "It's sad, but our government seems to have the attitude that no problem is too big, or too complicated, to be successfully ignored. But approaching certain selected officials did form the basis of our immediate safeguard—the 'Lifeboat' redoubts."

"Redoubts?" Vico frowned. "The word is not familiar."

"It's an archaic term," Volpone told him. "In the days of cavalry and sabers, it described an earthwork, a rampart thrown up to protect the defenders of a military position."

"I believe I understand. You convinced the government of the need for defensible hideaways against attack by atom bombs."

"Correct, though they never became fully convinced, I'm afraid. The upshot was a series of Federal allocations with which to build two underground redoubts—the first adjacent to the Baltimore-Washington ITTS tube, and another we're working on now out in California. You see, constructing and supplying the redoubts with breathable air goes hand-in-hand with building ITTS tubes. We've funded construction of . . . er, others on our own."

"Others?" asked Vico, interest in his voice. "How many others?"

Volpone said, "In all, there are forty-one redoubts."

The Don sat upright. "Forty-one! How big . . ? That is, how many individuals are to be saved in each of these . . . fortresses?"

"Each will accommodate fifteen to eighteen thousand computer-warned occupants in the event of attack," said Volpone, "with added space for growth as children are born underground."

"Children!" Vito Vico stared at the younger man for several seconds. "Alessandro, you would not jest with an old man?"

"Never, Vito. It would be an extremely unfunny joke."

"In the names of all the Saints, how *long* must these poor . . . Lifeboat people remain in their holes in the ground?"

"Years. Perhaps as long as twenty-five years—until the Earth above them cleanses itself of radioactivity."

Vico passed through another lengthy period of silence. "And *that* is your 'short-term' safeguard—twenty-five years? They will breathe," asked the Don in awe, "work, sleep, eat, and make love?"

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"Deep down in the Earth's crust," assured Volpone.

"I'm almost afraid to ask about your 'club' to hold over the heads of our enemies. Project Luft, is it?"

Volpone looked haggard. He leaned close to the Don. "Vito, our long-term solution is absolutely fantastic."

"Alessandro, I believe you!" Vico shuddered slightly. "Remember, I have already had one mild heart seizure."

Volpone became very sincere. "Fantastic both in concept, and as it's being carried out. Funding Luft is the reason why I came begging to you this evening; continuing our air storage tank and compressor building programs is *vital.* It's . . . tell me; do you ride the ITTS trains often?"

Vito Vico had a dazed look about him. "Seldom. Driving out to see you this afternoon is the longest trip I've undertaken in weeks. Alessandro, can you really be serious about all of this?"

"Deadly serious. You're familiar with the pneumatic-driven tube trains, aren't you? Compressed air pushes the cars—"

"Vaguely familiar." The Don waved his hands helplessly. "Your company manufactures the air compressors. Am I wrong?"

"You're perfectly correct," said Volpone. "But what very, very few people know is that we have also been building vast numbers of intake impellers and huge compressors designed to snatch air and store it at thirty-two hundred atmospheres in enormous pressure vessels constructed of steel and reinforced concrete."

"Air," guessed Vico, "for the underground people to breathe."

Volpone's smile was charitable. "In addition to that," he said. He started to continue, then paused. "Vito, have you heard of malaise, the respiratory complaint which recently drove the inhabitants of high-altitude locales like the Himalayas in Tibet, or the high Andean plateau, down toward sea level?"

Vico looked smitten. "I confess that I have not."

"Malaise is a debilitating weakness caused by anoxia, the lack of sufficient air to breathe. It's the first perceivable symptom resulting from Project Luft, our long-range program to slowly but surely deplete the Earth's air blanket."

Vico blanched. "You are stealing the Earth's atmosphere?"

"Slowly but surely," repeated Volpone solemnly. "Or at least a significant portion of it. No one will be protected, Vito, except those fortunate, chosen few who will populate the redoubts. Carried to ultimate fruition, generations hence, Project Luft could depopulate the Northern Hemisphere, if not the entire Earth."

Don Vito Vico made the sign of the cross on his frail chest.

TO BE CONTINUED

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The Artist and the Computer:

A Revolutionary Symbiosis

Mathematics, science and art joined forces early in the Renaissance to revolutionize painting and sculpture.
Now these forces are joining again to produce a new artistic revolution.

DAVID L. HEISERMAN

Engineers and artists make strange bedfellows. But whenever the two do manage to get together on the same idea, photography for example, the results are generally nothing less than revolutionary. Today, another of these rare meetings of technical and artistic minds is taking place. And the results promise to be no less revolutionary than photography has been.

It is easy to identify technology's representatives at this meeting of minds. They are computer engineers and programmers. It is more difficult, however, to say just who the artists are. They are a peculiar breed that recognizes the creative potential of a symbiosis between an artist and a computer that can draw pictures. These are artists who realize that the speed of modern graphics computers will let them immediately unleash a spark of subjective insight that would die by the time they found the right combination of brush strokes or the proper chisel to apply to a block of stone.

This new creative medium is in-

This photo shows a stop action sequence of computer drawings superimposed over a picture of Dr. Charles Csuri, a pioneering computer artist at Ohio State University. The computer is displaying (via a TV-like screen) a real-time animation of a helicopter flying in an elliptical path. Professor Csuri is holding a light pen, one of the most versatile drawing tools for computer art.

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teractive computer graphics. And its output, still inadequately named, is a computer-drawn image that can range in complexity from a single point of light to an engineering drawing of a bridge to an artist's impression of a tropical sunset—all animated in real time and, within a year or two, in three dimensions.

The basic hardware configuration of an interactive graphics computer system closely resembles that of a typical data processing system. In a typical data processing system, an operator loads instructions, or programs, and data into the system via an input device such as a punch card reader, a paper or magnetic tape reader, or a teletypewriter (TTY) keyboard.

Electrical signals that emerge from the input device are still in a rather raw form, thus the input interface unit has the job of translating these raw electrical signals into a digital format that is compatible with the central processing unit (CPU). The input interface unit also acts as a short-term memory and traffic controller for the input data by establishing queue lines, assigning routing and identification codes to the digital words, and allowing data to enter the CPU only when the processor is ready for it.

The CPU is the very heart (or brain) of every computer system. It is the section that actually performs the operations prescribed by the programs. And even the smallest CPUs have some built-in memory space. A good share of this memory space serves as a storehouse for operational programs, while the remainder acts as a short-term memory section—the kind of memory needed for "remembering" the results of one operation just long enough to acquire the next instruction or bit of data.

Since the memory capacity of a CPU is relatively small and nearly always fully occupied with operational programs and short-term memory operations, a separate long-term memory section becomes a necessity in most instances. The long-term memory section can take the form of magnetic tape machines or rapidly spinning magnetic disc and drum recorders.

Actually, the long-term memory section is a combination input/output (I/O) device. Like the other input and output devices in the computing system, the long-term memory section requires the aid of an interface unit to translate and control memory information flowing into and out of it.

The output end of a typical data processing system consists of an output machine such as a high-speed printer, a TTY, a magnetic tape recorder or an Alpha-numeric cathode ray tube (CRT) terminal. The output device translates computer-generated information into a format that is readily under-

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standable by humans or by other machines.

An output interface unit, standing between the CPU and the output device, translates CPU-oriented digital information into an electrical language compatible with the output device connected to it. Like the input interface unit, the output interface also performs data queuing operations. But, in this case, the data queues can become exceedingly long because the CPU generates data much faster than any electromechanical output device can reproduce it. Thus, the output interface unit is generally the site of giant data bottlenecks, and it must be able to queue the output data without letting any of it get lost or scrambled.

To get a better appreciation of the essential nature of interactive computer systems, it is important to note that a block diagram for a typical data processing system implies a one-way flow of information. The operator places programs and data into one end of the system and retrieves the finished results at the other. That's all there is to it. The output has no direct influence upon the input.

Interactive computer systems have the same basic configuration, but with one notable exception: the interactive systems include a feedback loop between the output and input sections. A number of modern data processing systems, especially those used in scientific and engineering applications, close the loop between output and input via a human operator and a TTY terminal. The computer can print out requests, usually written in plain English text, for essential information (e.g., the exact time of day) or further instructions. The operator must respond by typing out the requested information before computing operations can resume. The feedback loop that characterizes interactive computer systems sets up a symbiosis between man and machine that adds challenging new dimensions to human thought and the capabilities of computing machines.

In principle at least, the only real difference between the interactive computer system just described and an interactive graphics system is the kind of I/O devices they use. Instead of using a TTY as an I/O device to complete the feedback loop, for instance, an interactive graphics system uses a CRT as an output device and some sort of hand-operated "drawing" tool as an input device, although in graphics operations requiring a high degree of precision, TTYs sometimes make better input devices.

One of the simplest graphic input "drawing" tools is a joy-stick controller. A joy-stick controller has a small lever the operator can move from side to side or to and fro much as a pilot can move the control stick in an aircraft. Ultimately, any motion of the joy stick

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results in a similar kind of motion of a spot of light on the CRT screen.

A pair of servos or rheostats connected to the joy stick produce electrical signals that represent the instantaneous X-Y coordinates of the lever. The input interface units used with joy-stick controller translate these X-Y signal levels into digital words that are compatible with the CPU and output interface unit.

The output interface unit uses the X-Y coordinate information to generate a set of X and Y deflection signals that position the electron beam on the CRT screen. At this point in the discussion, it is sufficient to say the spot on the CRT has the same X-Y coordinates as the lever on the joy-stick controller.

In one of its simplest operating modes, a joy-stick graphics system merely makes the spot of light on the CRT mimic the motions of the control lever. In a more exciting and useful operating mode, the spot of light on the screen leaves a trail of light as it moves about. Thus, moving the joy-stick control lever through a circular path produces a drawing of a circle on the CRT.

CRT phosphors, however, have very short trace memories. Without the aid of some auxiliary electronics, any trail of light generated by the spot moving about on the screen fades away within a small fraction of a second. A special kind of CRT, known as a storage tube, has the ability to store traces almost indefinitely; but the "write" and "erase" times are far too long for high-speed graphics operations. This means the output interface unit must not only have provisions for positioning the electron beam on the CRT, but must also contain circuits for storing and repeatedly retracing the entire presentation. Ideally, the output interface circuits refresh the display more than fifteen times per second—the minimum frequency required to avoid any perceptible amount of image flickering.

A joy-stick controller is a simple and inexpensive input tool for interactive graphics systems; but it lacks a feature that is sometimes quite important from a human engineering point of view. Artists and engineers alike are accustomed to moving a drawing tool over the same surface that displays their handiwork. A joy-stick controller makes no physical contact with the CRT screen. As trivial as this "no-contact" argument may seem at first, it contributes heavily to the fact that joy-stick controllers now have limited applications as drawing tools in commercial interactive graphics systems.

The graphics input device that answers the need to work directly on the display screen is a light pen. Moving this pencil-like device across the surface of the CRT gives

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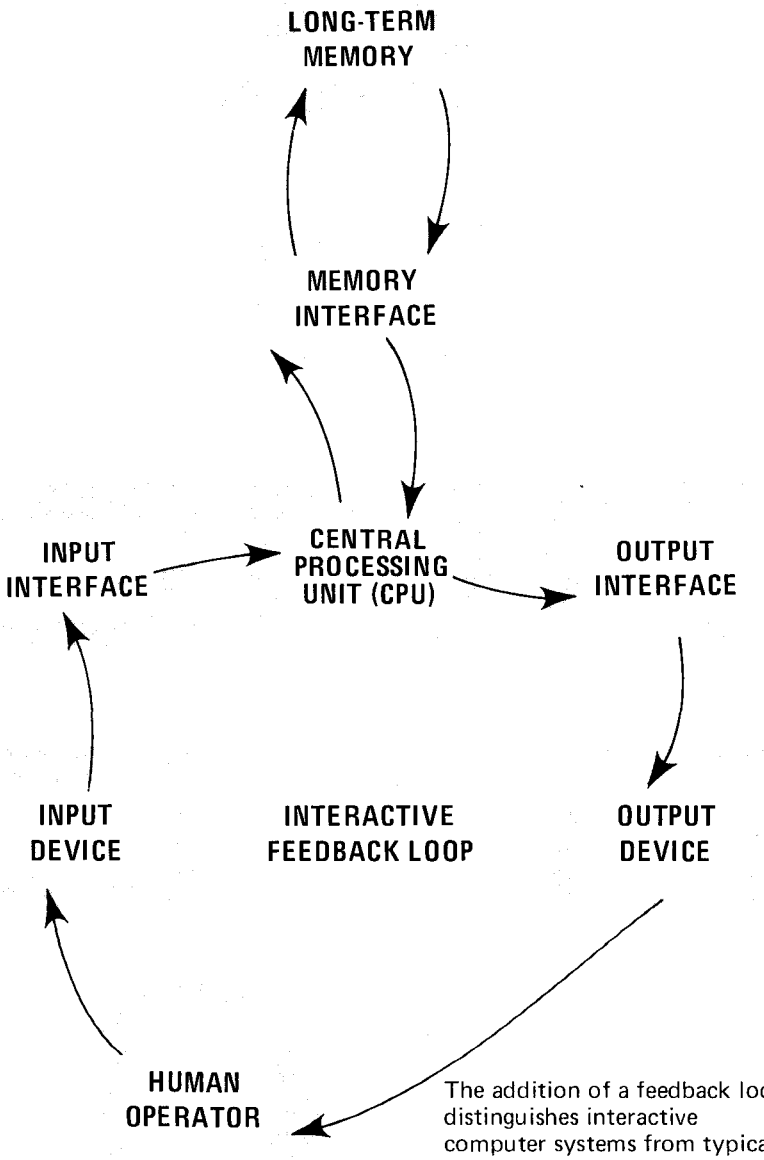

The addition of a feedback loop distinguishes interactive computer systems from typical data processing systems.

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the user the impression he is actually drawing with light. In the hands of a competent artist, a light pen seems to be a special kind of chalk he can use to sketch any figure or scheme he chooses.

A light pen has a sensitive photodetector built into its "writing" tip; and whenever it rests directly over a special cursor mark on the CRT screen, it sends a signal to the output interface. As the operator attempts to slide the tip of the light pen away from the cursor, tracking circuits in the output interface immediately sense a loss of signal from the pen, and move the cursor until it falls directly under the light pen once again. The "hunting" phase of the pen tracking operation takes place so rapidly and over such a small space that the pen seems to drag the cursor smoothly across the screen.

Output interface circuits that generate the cursor, make it track the light pen, and automatically generate and record its coordinates, account for the additional complexity of systems equipped for light-pen inputs. Of course the output interface unit must also contain the same kind of display refresh circuits and X-Y deflection generators used in the joy-stick systems. The whole output interface scheme often becomes so complex in high-performance interactive graphics systems that users can often justify replacing all but the analog X-Y deflection circuits with a minicomputer. Nevertheless, the versatility and creative "power" of a light pen makes it the most popular freehand graphics input device used today.

Thus far, the CPU hasn't played a very important role in this discussion of interactive graphics. In fact, the interactive systems outlined to this point can operate as described without the help of a central processor. But to this point, the discussion has barely touched upon the tricks a full-blown interactive graphics system can perform.

One of the most useful drawing routines programmed into graphics CPUs is a "straightedge" routine. Whenever a draftsman using ordinary pencil and paper wants to draw a straight line between two points, he has to use a straightedge of some sort to guide the pencil. A similar kind of mechanical straightedge would be useful for drawing straight lines with a light pen, too; but a straightedge computer program can take care of the straight-line problem just as effectively—and automatically.

After depressing a control button that calls up the straightedge program, the operator places the light pen at the starting point of the line he wants to draw and moves it toward the desired end point. No matter how much he wiggles the pen as he moves it along, the straightedge routine keeps the line between the starting point and the tip of the pen perfectly straight.

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Using the straightedge routine, an operator can draw complex straight-line figures in about a tenth the time it takes a skilled draftsman to do the job on paper. If he chooses, the operator can make permanent, high-quality reproductions of his drawing by taking a photo of the CRT screen or by connecting an X-Y plotter to the output of the system.

There is virtually no limit to the number of CPU programs that can make the light-pen drawing job easier and faster. Another example of a handy drawing aid is one that automatically generates circles. Such a "circle" program makes the system draw perfect circles on the CRT at the touch of a switch. The operator can then use the light pen to drag a circle to any point on the screen, and he can manipulate another set of switches to change the circle's size. What's more, every time he depresses a "repeat" function switch, another perfect circle appears on the screen.

The same computer routines that let the operator move circles, change their size and multiply their number can also work for any figures drawn on the screen. One artist/operator with a sense of humor drew a single figure of a rabbit on the screen. Using the appropriate controls, he quickly filled the screen with a whole family of identical, postage-stamp size rabbits.

Even these CPU functions are little more than handy drafting aids—the operator can get no more information from the pictures than he puts into them. (A square is still a square, no matter how perfectly drawn or changed with respect to size and position on the screen.) During the early 1960s, a few artists/programmers hoped to coax some orginality out of computer displays by programming them to draw quasi-random pictures; but in most cases, this new "computer art" was disappointing from an artistic point of view.

The real potential of computer interactive graphics began to make itself known shortly after engineers developed programs that could automatically add a three-dimensional perspective to figures on the screen. Rather than resorting to time-consuming tricks draftsmen must use to make perspective drawings, computer operators can enter true X-Y-Z coordinates for a vanishing point and the corners of a three-dimensional object. The straightedge program interconnects the critical points and the perspective program corrects the length and slope of the lines to produce the perspective effect.

It is important to note that a TTY, or other digital input device, replaces light pens for perspective-generating modes of operation. Although light pens are almost ideal input devices for making freehand drawings and guesstimates of perspective views, their two-dimensional nature makes them poor 3D

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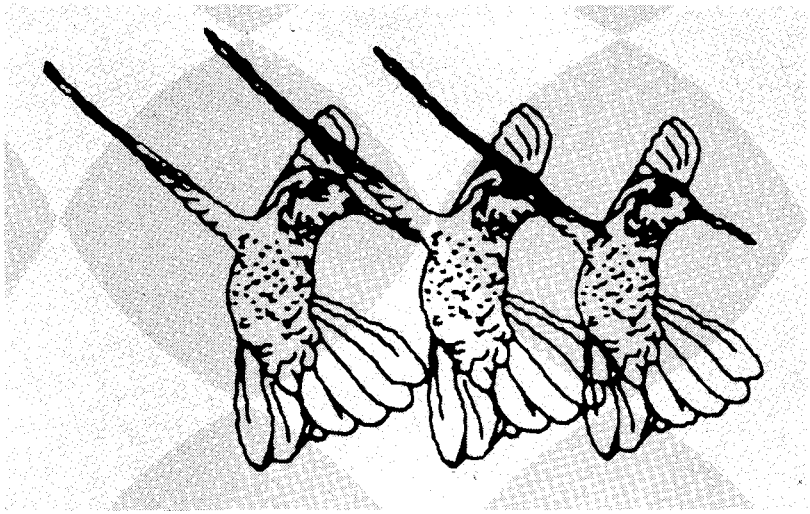

Computer Art Today—This sequence of computer drawings comes from Dr. Csuri's prize-winning experimental film, "Hummingbird."

drawing tools. Light pens, however, may still be used as control instruments for moving objects on the screen and indicating zoom paths.

Like engineering drawings on a sheet of paper, the perspective-corrected figures are still just two-dimensional representations of three-dimensional objects. The perspective programs, though, stimulated graphics researchers to develop other programs that allow the user to rotate his perspective drawings on the screen. With a rotation program at work, the operator can enter true X-Y-Z coordinates for a figure resting in its standard, or simplest, position. (It is far easier to determine the true coordinates for a cube that is resting in a standard face-on position than one that has a corner projected out toward the viewer.) After entering the standard-position coordinates, the operator can call up the rotation program to place the figure into any viewing position he chooses. Of course the perspective program automatically corrects the perspective throughout the rotation operations.

At first, the operator could only rotate the figures in incremental steps. The only way to produce the impression of a smooth rotation was by synchronizing a movie camera or video recorder to the incremental changes, and viewing the results second-hand later on. Today's faster and more sophisticated CPUs, however, make it possible to

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rotate all but the most complicated patterns in real time.

Another refinement of the perspective program permits the operator to zoom the figures in and out of an imaginary third dimension. The operator can use a TTY to "draw" the figure and a light pen to indicate its zoom path. Dr. Charles Csuri, a pioneering computer artist at The Ohio State University, has applied perspective and zoom programs to a line drawing of a helicopter. The helicopter, rotating blades and all, "flies" out toward the observer, makes a smooth banking turn, and moves away toward an imaginary horizon. Professor Csuri's computer-generated film, "Hummingbird," won awards at the 1967 Brussels Experimental Film Festival.

The coming of perspective and rotation programs also gave rise to a set of the most sophisticated programs yet devised for computer interactive graphics—programs that solve the so-called hidden-line problem. The figures described thus far have the appearance of being constructed of wire. That is, the observer can see all points and lines equally well, regardless of the object's orientation on the screen. The hidden-line problem states that all points or portions of lines in a perspective drawing that lay behind "opaque" surfaces must not appear on the screen.

To date, researchers haven't solved all the difficulties associated with the hidden-line problem. In principle, the problem isn't difficult to solve, but it generally takes the computer a long time to do the job. Researchers have managed to work out some fast hidden-line programs for the special case of convex figures (those that have no visible inside surfaces and edges). An example of a simple convex object is a child's toy block. A good hidden-line program enables an operator to draw an image of a solid-looking toy block and tumble the figure without the "hidden" lines and surfaces showing.

There is still a lot of work in store for researchers working on the hidden-line problem for the concave case. Concave objects have inside surfaces and lines that must appear whenever the image is rotated into certain positions—a box having one open end, for example. There are a few relatively fast hidden-line programs for the concave case available now, but they apply to only a few popular kinds of figures.

The hidden-line programs put more strain upon a CPU's data-handling capacity than any other graphics programs in use today. Combine these programs with those for real-time rotation, perspective correction and zoom functions, and manipulating a moderately complex figure on the CRT quickly loads present-day computers to near capacity. A half-tone shading program that highlights surfaces facing

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an imaginary light source multiplies the computing demand by another order of magnitude.

Computer graphics researchers now have two avenues open to overcoming the problems of overloading their computer systems: they can look for funds to buy bigger and faster machines, or they can work out streamlined versions of the present programs. The latter alternative is much more attractive in most instances, partly because of the high cost of new machines and partly because the refinement of presently available programs is a highly desirable and intellectually rewarding pursuit.

Stereoscopic interactive graphics occupies the frontiers of the technology at the present time. The need for stereoscopic representations of computer-generated figures comes from the fact that 3D images can convey far more visual information than their 2D counterparts can. Researchers are now working on several different schemes for producing stereoscopic images on CRTs. The two most promising techniques use CPU programs to generate a stereoscopic pair of images. In one instance, the two images appear side by side on the same standard 27-inch viewing screen. The other method uses two separate CRTs—one for each of the stereoscopic views.

To produce a stereoscopic image, the operator can enter the essential coordinates of a figure just as though he were working with a normal 2D graphics system equipped with a perspective correction program. The figure he "draws" appears as one of the two stereo images. Even while he is still entering data, the stereoscopic program in the CPU is calculating coordinates for the complementary image and beginning to draw it on the CRT.

The rotation, hidden-line and zoom programs apply to stereo presentations, too; however, the data-handling capacity of the system is effectively cut in half because it must work with two slightly different images simultaneously.

The single-screen stereo technique is especially attractive because it requires only an optical stereo viewing instrument as additional hardware. The main disadvantage is that the operator is free to work on only half the screen. Adopting the two-screen method maintains the full 27-inch working area; but of course the need for an additional CRT terminal makes this method a rather expensive one.

Researchers are now talking about a variation of the two-screen output technique that will use a pair of one-inch CRTs connected together much like the lens tubes on a pair of binoculars. A pair of one-inch tubes are less costly than a single 27-inch CRT terminal; and because the operator places his eyes within several inches of the

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small screens, the images nearly fill his field of view.

The engineering and scientific applications of stereoscopic interactive graphics might seem obvious at this point. Three-dimensional mechanical drawings, for instance, convey far more vital engineering information than any two-dimensional representations can. Add to this the ability to rotate the simulated structures in real time and the capability of subjecting them to simulated stresses, and conventional paper-and-pen graphics begins to look as outmoded as stone tablets. As far as scientific applications of 3D interactive graphics, imagine a chemist being able to study the form and mechanical behavior of complex organic molecules in three dimensions.

Simulating real situations for training purposes opens another whole world for computer interactive graphics. Although there are a number of elaborate and effective optical-mechanical-electronic simulators in use today, there is an informal law (Murphy's Law?) that says any system made from complex combinations of optical, mechanical and electronic sub-systems is bound to be full of bugs. Three-dimensional interactive graphics makes simulation systems almost a hundred-percent electronic. Murphy's Law may still call for a few bugs in the system, but at least they will all be of the same strain.

To many people, the engineering, scientific and simulation applications of computer interactive graphics may seem exciting enough. But those afflicted with a need to express more subjective notions will find unparalleled excitement in computer art. As Professor Csuri puts it: "The process of creating images . . . involves an exciting new concept of time. Whatever the artist decides to do is transmitted almost instantaneously to the screen. This allows for a full interaction between the artist and his images. It makes the creative process a very spontaneous thing, for all the problems of execution are solved in advance."

Whereas light pens and joy sticks lose out as useful drawing instruments when it comes to engineering precision, the free-wheeling spirit of an artist feels confined by the monotony of a TTY input. Unless precision and accuracy are his aims, a computer artist feels he must return to the freehand input devices—especially those modified for use with a stereoscopic interactive graphics system.

Joy-stick controllers for 3D interactive graphics work on the same basic principles as the 2D controllers described earlier; but with one important difference—the addition of a Z-axis feature. A 3D joy-stick controller uses a small knob attached to a system of levers that allow the operator to move it freely inside a one-cubic-foot space. Servos or rheostats attached to the le-

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vers produce electrical signals representing the instantaneous X, Y and Z coordinates of the knob. The computer processes this information in much the same way it does for a 2D joy-stick system. In the 3D case, however, the CPU plays a much more important role because it must adjust lines for perspective as the figure rotates, generate stereoscopic pairs of images, and perform the hidden-line functions.

With a 3D joy stick connected to a stereo graphics system, the operator moves the knob about freely while observing the resulting lines in the 3D viewer. Moving the joy-stick knob up and down produces lines that lie in a plane. Whenever he pulls the knob toward him, the trace on the screen appears to jump out toward him; and pushing the knob away makes the line appear to move back toward an imaginary horizon.

A fully-equipped 3D interactive graphics system gives the artist an exciting medium of expression that is entirely different from anything he, or anyone else in the world, has ever seen before. Working with such a system is something like sculpturing with chalk—an absurd notion (until now, anyway).

Suppose a computer artist wants to draw a 3D image of a girl's face and head. He can start by sketching a three-dimensional face-on view. By manipulating the rotation controls, he can then turn the figure 180 degrees and draw the back of her head. After that, he can rotate the figure several more times and sketch both sides and the top of her head. As a finishing touch, he can specify an imaginary light source, and let the half-tone program automatically take care of the necessary shading. The result is a stereoscopic image that can be rotated and viewed from any desired position.

The ability to make such 3D "sculptures" on a CRT screen by "sketching" with a 3D input device brings this discussion of computer interactive graphics to the very limits of present-day achievement. As should be expected, however, a few researchers are already planning the next steps.

One of these next steps includes adding the dimension of touch to the 3D images by outfitting a joy-stick controller with an electromechanical feedback system. Once the operator draws a "solid" object on the screen, he can use the joy stick as a feeler to physically probe at the image. A cursor on the screen will indicate the relative position of the joy-stick knob; and as the operator moves the cursor into contact with the image, the feedback mechanism will brake the knob's motion. As Dr. Csuri describes this effect, "It will be like trying to identify an object in the dark by poking at it with one finger." But he hastily adds, "It is only a beginning."

Dr. Csuri's hastily added com-

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ment applies to interactive graphics in general. Bell Laboratories, for instance, has developed a computer graphics system that can directly generate holograms of any object drawn on the CRT. At the present time, it takes several minutes to generate a single hologram this way (thus the images must be stationary). Nevertheless, it is quite likely that a computer artist will one day display his handiwork as truly three-dimensional holographic projections suspended freely in space. Observers will be able to walk around the art work, looking at it from all possible angles. Within the next decade, it may be possible to add some simple and repetitive motions to the lifelike holographic displays. As the computer-generated holographic process becomes even further refined, there will be no reason why holographic projections cannot replace the CRTs for real-time, animated displays of graphic computer outputs.

Even without the help of holography, it will only be a matter of several years before computer artists can draw 3D simulations of large and complex objects such as a house. Once he sketches the house and its contents, he can use the motion controls to give himself the impression he is walking up to the front door. He can enter the house through the door (or through a wall if the rules of the program permit such a gross violation of reality) and view the contents of the house at will. He can look out of a window and see a scene that might include cars moving along the street and perhaps even a few people going about some imaginary tasks.

The computer operator can become the master of a world of his own. He can move about as he chooses, and he can use a 3D drawing tool to create or destroy anything he chooses. On a typical workday, this computer artist might journey casually to the edge of his world, and spend the day extending its limits by drawing more trees, mountains and villages. ■

ABOUT THE AUTHOR

David L. Heiserman has been a full-time free-lance science and technical writer since 1969. More than forty of his feature articles have appeared in *Popular Electronics*, *Electronics World*, *Popular Science* and *Science Digest*. He is a contributing editor for *Popular Electronics*, and is presently working on a junior high school electronics textbook and a series of electronics handbooks. He studied applied mathematics at The Ohio State University, and teaches that subject part-time at Franklin University in Columbus, Ohio. He has also worked as an electrical engineer and technical communications consultant for a number of Ohio manufacturing firms. He is a member of the American Association for the Advancement of Science.

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A Mind of His Own

When someone says, "I know what's best for you," he generally means, "Here's what I want you to do."

JOE HALDEMAN

LEO SUMMERS

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"What we need is a technology of behavior . . . were it not for the unwarranted generalization that all control is wrong, we should deal with the social environment as simply as we deal with the nonsocial."

—B.F. Skinner

Leonard Shays came back home to Tampa from the Lebanese conflict with a chestful of medals—which was no distinction—a slightly fractured mind, a medical discharge and two fairly efficient prosthetics, replacing his left foot and the right leg from the knee down.

The single-shot laser booby trap he had triggered on patrol in the slums of Beirut had been set to scan at chest level, to kill. But Leonard, canny with experience, had tossed in a microton grenade before entering the hovel, and the explosion jarred the mounting of the booby trap so that it scanned in a downward slant across the doorway. It was practically no pain at first, much pain later, and now just a feeling that his nonexistent toes were curled down in spastic paralysis. It made it hard to walk but the VA was giving him therapy. And he couldn't get a job, not even with his PhD in mathematics, but the VA was also giving him a small check on the first of every month.

"Morning, Dr. Shays." His favorite therapist, Bennet, closed the bathroom door quietly. "Ready for the workout?"

"Am I ever? Ready to get out of this damn thing, though." Bennet picked up Leonard gracelessly and pulled him out of the whirlpool bath. He set him on the Formica edge of a table and gave him a starchy towel.

He studied the stumps professionally. "How's the wife?"

"Don't ask," he said, scrubbing sweat from his hair. "We had a long talk Friday. Our contract comes up for renewal in '98. She decided not to renew."

Bennet turned off the motor and pulled the plug on the bath. "It's her right," he said. "Bitch."

"It's not the legs. Absence thereof. She explained that carefully, at some length. It's not the legs at all."

"Look, if you don't wanna . . ."

"It's not that I can't get a job and we had to move to Ybor City and she has to carry a gun to go shopping."

Bennet grunted and straightened a stack of towels.

Leonard fumbled through his clothes and got a cigarette, lit it.

"Shouldn't smoke those things in here."

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"Just leaving." He draped a gray robe around his shoulders. "Help me with this thing, OK?"

Bennet helped him put on the robe and set him in a wheelchair. "Can't smoke in Therapy, either."

Leonard put the clothes on his lap and turned the chair a hundred and eighty degrees on one wheel, hypertrophied biceps bulging. "So let's not go straight to Therapy. I need some fresh air."

"You'll stiffen up."

He rolled to the door and opened it. "No, it's warm. Plenty warm."

They were the only people on the porch. Bennet took a cigarette and pointed it at one of the palm trees.

"You know how old that one is?"

"She said it was because of the *piano.*"

"Yeah, you shouldn't of sold the piano."

"Couldn't work the pedals right."

"Someday you--"

"I wasn't going to sell it anyhow; I was going to trade even for classical guitar or lute if I could find somebody."

"Yeah?"

"I went to all the skill-transfer agencies. Every one, here and St. Pete. Even one in Sarasota, specializes in music. Couldn't find a guitar player who was any good. Not in Bach. If I can't play Bach I'd rather just listen."

"You coulda gotten one that was otherwise good. Learn Bach on your own."

"Bennet, hell, that'd be years. I never learned that much new on the piano, either. Don't have the facility."

"You bought the piano in the first place?"

He nodded. "One of the first skill transfers in Florida. Old Gainesville conservatory man. He thought he was going to die and wanted one last fling. Paid him fifty grand, that was real money back in '90."

"Still is."

"They cured his cancer and a year later he committed suicide." He threw his cigarette over the edge and watched it fall three stories.

"It's exactly as old as I am. Fifty-one years, the gardener told me," Bennet said. "I guess that's pretty old for a tree."

"Palm tree, anyhow." Leonard lit another and they smoked in silence.

"I wouldn't have sold it except my car went bad. Turbine blades crystallized while I was stuck in traffic. Had to get a new engine, new drive-train. Try to get around this town without a car."

"It's worth your life," Bennet agreed.

Leonard snapped the new cigarette away. "Might as well get going."

He was always tired after therapy

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but he always hobbled down to the gate and across to the little tavern, drank a beer standing up and walked back to the parking lot. He'd found that if he didn't walk about a mile after therapy he would hardly be able to get out of bed the next morning, for the stiffness.

He went home and was surprised to find his wife there.

"Good afternoon, Scottie." He walked in unsteadily, carrying two bags of groceries.

"Let me help."

"No." He set the groceries down on the dinette table and began to take out things to go into the refrigerator.

"Aren't you going to ask me what the hell I'm doing here?"

He didn't look at her. "No. I'm very calm today." He took the frozen foods over first, elbowed the door open. "Therapy today."

"Did it go well?"

"Besides, it's as much your house as mine."

"Until January. But I don't feel that way."

"It went pretty well." He shuffled things around in the refrigerator to make room for a scrawny chicken, the only luxury he had purchased.

"You got the car fixed."

"All it took was money."

"Have you tried to sell the baby grand?"

"No."

Carefully: "Does that mean you might buy back the talent some day?"

"With what?"

"Well, you—"

"I need the money to live on and the piano's yours to sell or keep or bronze or whatever the hell you want to do with it."

"You don't like to have it around because—"

"*I don't give a flying* . . . I don't care whether it stays or goes. I kind of like it. It's a fun thing to dust. It keeps the place from blowing away in a high wind. It has a certain—"

"Leonard!"

"Don't shout."

"It's not mine; I bought it for you."

"That's right."

"I *did.*"

"You did a lot of things for me. I'm grateful. Now." He shut the refrigerator door and leaned on it, drumming fingers, looking at the wall. "I'll ask. What the hell are you doing here?"

"I came back," she said evenly, "to try to talk some sense into you."

"Wonderful."

"Henry Beaumont said you told him you were thinking of selling your mathematics, too."

"That's right. After the money goes. It's not doing me any good."

"You worked nine years for that degree. Long years, remember? I was with you most of them."

"Five, to be accurate. Five years for the PhD. First a Bachelor's—"

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"If you sell your mathematics you lose it all the way back to grade school."

"That's true. Tell me something else old."

"Don't be difficult. Look at me." He didn't. "Daddy will—"

"That's really old. I don't want to hear it."

"Still trying to be a hero. Your courage is an inspiration to us all."

"Oh, for Christ's sake." He sat down at the kitchen table with his back to her. "You were the one who wanted out. Not me."

"Len, if you could see yourself, what you've turned into . . ."

Any time somebody starts out a sentence with your name, Leonard thought, *they're trying to sell you something.*

"Daddy said this morning that if you'd go to see Dr. Verden--"

"The imprint man he goes to."

"The best overlay therapist in the state, Len."

Early attempts at overlay therapy were called "personality imprinting." The name had a bad connotation.

"The principle's the same no matter how good he is." He looked straight at her for the first time. "I may be a worthless self-pitying bastard, but I am me. I stay me."

"That sounds pretty—"

"Pretty stupid from a man who's just sold one slice of his brain and talks about selling another. Right?"

"Close."

"Wrong. There's a basic difference between skill transfer and overlay ther—"

"No, there isn't, they're exactly the—"

"*Because,*" almost shouting, "I can shed skills when and as I feel I no longer have use for them, where your *im*print witch doctor just looks up in some God-damn book and finds a pers—"

"You're wrong and you know it. Otherwise—"

"No, Scottie. You've let your father sell you Tranquility Base."

"Daddy's been seeing Dr. Verden for fifteen years!"

"And see what it's gotten him?"

He wasn't looking at her any longer but he could see the old familiar counting gesture. "Money. Prestige. Self-fulfillment—"

"And whose self is he fulfilling? Every time I see the old guy I expect him to be Sinbad the Sailor or Jack Kennedy or some God-damn thing. Fifty years ago they would have locked him up and thrown away the combination."

"You act as if he's—"

"He is! Certifiably."

He heard the door open—"We'll see about that!"—and slide shut and he reflected that that was one improvement over their house in Bel Aire. You can't slam an electric door.

Leonard woke up stiff the next day in spite of his having exercised. He would have allowed himself an extra hour in bed, but today he

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despised the pathetic image of a naked, legless cripple lying there helplessly. He decided against the struggle of showering, taped the pads to his stumps, strapped on the prosthetics and pulled on a pair of baggy trousers.

It was intolerably muggy, so he threw economy aside and switched on the airco. While his coffee was heating, he unwrapped the latest *ASM Journal* and set it with a thick pad of paper and a pencil next to the chair that sat under the air-conditioning duct. The microwave cooker buzzed; he got his coffee and sat down with the first article.

The doorbell rang when he was on the second article and second cup of coffee. He almost didn't answer it. It was never good news. It rang again, insistently, so he got up and opened the door.

It was a small, bland-looking black man with a leather portfolio under his arm. *Salesman*, Leonard thought tiredly.

"Leonard Shays?" Leonard just looked at him.

"How do you do. I'm Dr. Felix Verden, you may—"

He pushed the button but Verden had a foot against the door jamb. The door slid halfway closed, then opened again.

"Mrs. Dorothy Scott Shays is your next of kin."

"Not any more, she isn't."

"I sympathize with your feelings, Dr. Shays, but legally she *is* still

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your closest relative. May I come in?"

"We have nothing to talk about."

He opened the portfolio. "I have a court order here authorizing me—"

Leonard teetered forward and grabbed a fistful of the man's shirt. A man in uniform stepped from where he'd been hidden, next to the wall beside the door, and showed Leonard his stunner wand.

"All right. Let me get my book."

Dr. Verden's office was comfortable and a few decades out of date. Pale oak paneling and furniture crafted of a similar wood, combined with blued steel and fake black leather. A slight hospital odor seeped in.

"You know the therapy will be much more effective if you cooperate."

"I don't want it to be effective. I'll go along with the court and surrender my body to you for treatment. Just my body. The rest is going to fight you all the way."

"You may wind up even worse than before."

"By your lights. Maybe better, by mine."

He ignored that by rustling papers loudly. "You're familiar with the process."

"More familiar than I want to be. It's like a skill transfer, but instead of subtracting or adding a certain ability, you work on a more basic level. Personality."

"That's correct. We excise or graft certain basic behavioral traits, give the patient a better set of responses to life problems."

"A *different* set of responses."

"All right."

"It's ghoulish."

"No it isn't. It's just an accelerated growing-up process."

"It's playing God, making a man over in your own image. Or whatever image is stylish or popular recently."

"You think I haven't heard all this before, Leonard?"

"I'm sure you have. I'm sure you ignore it. You must be able to see that it's different, being on the receiving end, rather than—"

"I've been on the receiving end, Leonard, you should know that. I had to go through a complete overlay before I could get licensed. I'm glad I did."

"You're a better person for it."

"Of course."

"That could be just part of the overlay, you know. They could have turned you into a slavering idiot and at the same time convinced you that it was an improvement."

"They wouldn't be allowed to. Overlay therapy is even more closely monitored than skill transfer. And you should know how many controls there are on that."

"You're not going to convince me and I'm not going to convince you. Why don't we just get on with it?"

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"Excellent idea." He stood. "Come this way."

Dr. Verden led him into a small white room that smelled of antiseptic. It held a complicated-looking bed on wheels and a plain-featured young female nurse who stood up when they came in.

"Will you need help getting undressed?" Leonard said he didn't and Dr. Verden dismissed the nurse and gave Leonard an open-backed smock, then left.

Verden and the nurse came back in a few minutes after Leonard had changed. He was sitting on the bed feeling very vulnerable, his prosthetics an articulated jumble on the floor. He was wondering again what had happened to his original foot and leg.

The nurse had a bright, pleasant voice. "Now please just lie down facing this way, Mr. Shays, on your stomach."

"Dr. Shays," Verden corrected her.

Leonard was going to say it didn't matter, but then that didn't matter either.

The woman offered him a glass of water and two pills and he wondered why she hadn't done so while he was still upright. "There will be some pain, Dr. Shays," she said, still with an encouraging smile.

"I know," he said, not moving to take the pills.

"They won't turn you into a zombi," Dr. Verden said. "You'll still be able to resist."

"Not as well, I think."

Verden snorted. "That's right. Which only means you'll go through the process a dozen times instead of two or three."

"I know."

"And if you could resist it perfectly, you could keep going back every other day for the rest of your life. Nobody ever has, though."

Leonard made no comment, wriggled into a slightly more comfortable position.

"You have no idea the amount of discomfort you're condemning yourself to."

"Don't threaten, Doctor; it's unbecoming."

Verden began to strap him in. "I'm not threatening," he said mildly. "I'm counseling. I am your agent, after all, working in your own best—"

"That's not what I got from the court order," Leonard said. "Ouch! You don't have to be so rough about it. I'm not going anywhere."

"We have to make you perfectly stationary. Biometric reference points."

Resisting personality overlay is not conceptually difficult. Every literate person knows the technique and most illiterates as well: first the best-selling novel, "Paindreamer," then dozens of imitative efforts, described it; then a couple of sensational flix, and finally the afternoon

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cube saga, "Stay Out of My Mind!"

The person strapped on the table need not concern himself with the processes (inductive-surgical/molecular-biological/cybernetic) going on, any more than he has to think about the way his brain is working in order to attack a regular problem. Because when the therapist attempts to change some facet of the patient's personality, the action manifests itself to the patient in terms of a dream-problem. More often, a nightmare.

The dream is very realistic and offers two or three alternatives to the dreamer. If he chooses the right one, his own will reinforces the aim of the therapist, and helps make permanent the desired cellular changes.

If he chooses the wrong alternative—the illogical or painful one—he is reinforcing his brain cells' tendency to revert to their original configuration, like a crumpled-up piece of paper struggling to be square again.

Sometimes the dreams have a metaphorical connection with the problem the therapist is attacking. More often they do not:

Leonard is sitting in the home of some good friends, a young couple who have just had their first child.

"It's just fantastic," says the young woman, handing Leonard a cold beer, "the way he's growing. You won't believe it."

Leonard sips the cold beer while the woman goes to get the child and the part of him aware that this is just a dream marvels at the solidity of the illusion.

"Here," she says, offering the baby to Leonard, laughing brightly. "He's such a rascal."

The baby is about a meter long but his head is no larger than Leonard's thumb.

"He's always doing that," says the husband from across the room. "He's a regular comedian. Squeeze his chest and watch what happens!"

Leonard squeezes the baby's chest and, sure enough, the head grows and the body shrinks until the baby is of normal proportions. He squeezes harder and the head swells larger and dandles over onto the shrunken torso, a giant embryo out of place.

The husband is laughing so hard that tears come to his eyes.

A line of worry creases the young woman's forehead. "Don't squeeze too hard—please Leonard, don't, you'll hurt—"

The baby's head explodes, red-dripping shot with gray and blue slime, all over Leonard's chest and lap.

"What did you go and do that for?"

Leonard has both his legs and they are clad in mottled green jungle fatigues. He is cautiously leading his squad down the Street of Redemption in Beirut, in the

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slums, in the steam bath of a summer afternoon. They crab down the rubble-strewn sidewalk, hugging the wall. Another squad, Lieutenant Shanker's, is across the street from them and slightly behind.

They come to number 43.

God, no.

"This is the place, Lieutenant," Leonard shouts across the street.

"Fine, Shays. You want to go in first? Or shall we take it from this angle?"

"If I . . . uh . . . if I go in first I'll lose my leg."

"Well hell," says the lieutenant affably. "We don't want that to happen. Hold on just a —"

"Never mind." Leonard unsnaps a microton grenade from his harness and lofts it through the open door. Everybody flattens out for the explosion. Before the dust settles, Leonard steps through the door. With the corner of his eye he sees the dusty black bulk of the one-shot generator. A bright flash and singeing pain as he walks two steps on his shinbones and falls, pain fading.

Leonard is fishing from a rowboat at the mouth of the Crystal River, with one of his best friends, Norm Provoost, the game warden.

He threads a shrimp onto the hook and casts. Immediately he gets a strike, a light one; sets the hook and reels in the fish.

"What you got, Len?"

"Doesn't feel like much." He lifts it into the boat. It's a speckled trout—a protected species—smaller than his hand, hooked harmlessly through the lip.

"Not big enough to keep," says Norm, while Leonard disengages the hook. "They sure are pretty creatures."

Leonard grasps the fish firmly above the tail and cracks its head against the side of the boat.

"For Chrissake, Shays!"

He shrugs. "We might need bait later."

A large seminar room. Leonard's favorite professor, Dr. Van Wyck, has just filled a third blackboard with equations and moves to a fourth, at his customary rapid pace.

On the first board he made an error in sign. On the second board this error caused a mistake in double integration, two integrands having been wrongly consolidated. The third board, therefore, is gibberish and the fourth is utter gibberish. Van Wyck slows down.

"Something's screwy here," he says, wiping a yellow streak of chalk dust across his forehead. He stares at the boards for several minutes. "Can anybody see what's wrong?"

Negative murmur from the class. Their heads are bobbing, looking back and forth from their notes to the board. Leonard sits smirking.

"Mr. Shays, your Master's thesis was on this topic. Can't *you* see the error?"

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Leonard shakes his head and smiles.

Leonard woke up awash with dull pain, mostly in the back of his skull and under the restraining straps. With great effort he tilted his head and saw that he was no longer strapped in; only fatigue was holding him down. Bright welts across his arms.

Vague troubling memories: equations, fishing, Beirut, small child . . . Leonard wondered whether he had resisted as strongly with his mind as he obviously had with his body. He didn't feel any different, only weak and hurting.

A nurse appeared with a small hypodermic.

"Wha?" His throat was too dry to talk. He swallowed, nothing.

"Hypnotic," she said.

"Ah." He tried to turn away, couldn't even find strength to lift his shoulder. She was holding him down with a light touch, swabbing a place on his arm with coldness. "You want to get well, don't you? It's only so the doctor can . . ." Sharp pricking and blackness.

He woke up feeling better the second time. Dr. Verden handed him a glass of water. He drank half of it greedily, paused to wonder if it was drugged, then drank the rest.

Refilling the glass: "That was quite a performance, Leonard."

"You know what I was dreaming?"

"We know what you remember having dreamed. You remember quite a lot, under hypnosis."

Leonard tried to sit up, felt faint, laid back down. "Did . . . am I still . . ."

Dr. Verden put down the pitcher, leafed through some pages on a clipboard. "Yes. You have essentially the same behavioral profile you had when you came in."

"Good."

He shrugged. "It's only a question of time. I think you were starting to respond to the therapy, toward the end. The State monitors recommended that I terminate before . . . actually, I had to agree with them. You aren't in very good shape, Leonard."

"I know. Asymmetrical."

"Bad jokes aside. It just means you'll have more sessions, of shorter duration. You'll be here longer. Unless you decide to cooperate."

Leonard looked at the ceiling. "Better get used to my being around."

Salad has just been served at a formal dinner and Leonard is eating it with the wrong fork. The young lady across from him notices this, and looks away quickly with a prim smile. Leonard replaces the fork and finishes the salad with his fingers.

Leonard and Scottie, newly married, are walking across the campus

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of the University of Florida, on a lovely spring day. She makes a sound between "Eek" and "Ack."

"It's just a snake, Scottie."

"It's *not* just a snake. It's a *coral* snake." And it is: red-touch-yella-bite-a-fella. "Leonard!"

"I won't hurt it." Leonard is chasing after it and with some difficulty picks it up by the tail. The snake loops around and begins to gnaw on Leonard's wrist. Scottie screams while Leonard watches the slow pulse of poison, holding on stoically even though the snake is hurting him.

Leonard repeats the Beirut dream in almost every detail, but this time he tries not to look at the laser booby trap before setting it off.

"You're weakening, Dr. Shays. Why don't you just give in, cooperate?" Dr. Verden said this into the clipboard, a few pages thicker this time, and then favored his patient with a cool stare.

Leonard yawned elaborately. "It occurred to me this morning that I won't have to resist indefinitely. Only until Scottie's father gets tired of paying."

Without hesitating: "He paid in advance, on contract."

"You're a good liar, Doctor. Facile."

"And you're a lousy patient, Doctor. But challenging."

Scottie came in for a few minutes and stood at the other end of the bed while Leonard delivered a nonstop monologue, full of bitterness but surprisingly free of profanity, about her failure as a wife and as a human being. During her stay she said only "Hello, Leonard" and "Good-bye."

The doctor did not come back in after Scottie left. Leonard sat and tried to think about the whole thing dispassionately.

If Scottie gave up on him, surely the old man would too. There was only a month to go before their marriage contract ran out. If Scottie let it lapse, he would probably be released immediately. He resolved to be even nastier to her if she visited again.

But could he last a month? Despite what Verden said, he had felt as much in control this session as he had before. And it seemed to have hurt less. Whether he could last another dozen sessions, though . . . well, he really had no way of telling.

Leonard never paid any attention to the soap operas and he made it a point of pride not to read best-sellers. He only had a sketchy, cocktail-party idea of what people thought went on in your head during overlay therapy. Supposedly, you resisted with your "will"—the term seeming to Leonard reasonably accurate but trivial—and a strong-willed person thus could defend his identity better than a weak person could. But there were limits,

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popular wisdom said, dark limits of stress that would break the most obstinate.

In fiction, people often escaped therapy by refusing to come out of one of the induced dreams—a pleasant dream always coming around at just the right time—by some application of existential *machismo* that was never too well explained. Pure poppycock, of course. Leonard always knew what was going on during a scenario, and he could control its progress to a certain extent, but when the pivotal moment came he had to take some action (even inaction was a decision) and then the dream would fade, to be replaced by the next one. To decide to stay in one dream was as meaningful as making up your mind to stay on a moving escalator, by effort of will, after it had reached the top.

Physical escape out of the question, it looked to Leonard as if his only hope was to keep plugging away at it. The monitors kept Verden from exhausting Leonard or drugging him; such measures could only be taken in rehabilitating a felon or a "dangerously violent" patient. Ironically, Leonard had been against the idea of the monitors when Federal law had created them to enforce "mental civil rights." It had seemed like a sop thrown to an hysterical electorate after "Paindreamer." But maybe the government had been right, just this once.

Fake a cure? Impossible unless you were a consummate actor and a psychometrics expert. And Verden checked your behavioral profile under hypnosis.

For a few moments Leonard considered the possibility that Verden and Scottie were right, that he was actually coming loose from his moorings. He decided that, although it might be true, it was an unproductive angle of attack.

He supposed that a technician—maybe even Verden himself—might be bribed, but the money he had received for his piano was inaccessible and probably not enough anyhow.

Best to just stick it out.

Leonard is in an unfamiliar uniform, seated at a complicated console. He sits in front of a wall-sized backlit map of the world; North America and Europe covered with blue dots and Asia covered with red dots. Central to the console is a prominent keyhole, and a matching key dangles lightly on a chain around his neck. His left side is weighted down by a heavy pistol in a shoulder holster. A plate on the console winks every thirty seconds: NO GO. There is an identical console to his right, with another man identically accoutered, who is apparently quite absorbed in reading a book.

So they are the two men who will set in motion the vengeance of the Free World in case of enemy

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attack. Or adverse executive decision.

The plate blinks GO, in red, stroboscopically. A teletype behind them starts to chatter.

The other man takes his key and hesitates, looks at Leonard. Says a simple word.

Which is the wrong way to act? Leonard wonders. If he shoots the man, he saves half the world. If they both insert their keys, the enemies of democracy die. But maybe by the logic of the dream they are supposed to die.

Leonard takes the key from his neck and puts it in the hole, turns it counterclockwise. The other does the same. The plate stops flashing.

Leonard unholsters his pistol and shoots the other man in the chest, then in the head. Then, fading, he shoots himself, for good measure.

Then there are four dreams offering less and less clear-cut alternatives.

Finally, Leonard is sitting alone in front of a fireplace, reading a book. He reads twenty pages, about Toltec influence on Mayan sculpture, while nothing happens.

He decides not to read for a while and stares into the fire. Still nothing happens. He strips pages from the book and burns them. He burns the dust-jacket and the end boards. Nothing.

He sits down, unstraps one leg and throws it into the fire. The prosthetic foot follows. He watches them melt without burning.

After a couple of hours he falls asleep.

Dr. Verden did not come to him after this session was over. He woke up, the nurse gave him a hypnotic, he woke up again later. Then he spent a day leafing through magazines, watching the cube, wondering.

Was Verden trying to trick him in some way? Or did the ambiguity of the dreams mean that the therapy was succeeding? The nurse didn't know anything, or just wasn't talking.

As far as he could test himself, Leonard didn't feel any different. He was still full of rage at Scottie and Verden, still quite willing to sell his mathematics when money got low—and didn't regret having sold the piano—still felt that imprinting a person who was manifestly sane was a gross violation of privacy and civil rights.

Leonard has another session, of seven dreams. In the first three the result of his action is ambiguous. In the next two, it is trivial. In the sixth it is obscure. In the seventh, Leonard is a catatonic lying motionless, for a long time, in a hospital ward full of motionless catatonics.

This time Verden appeared without white smock or clipboard.

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Leonard was surprised that seeing him in a plain business suit, stripped of symbols of authority, should make such a difference. He decided that it was a conscious masquerade.

"The last two sessions have been very alarming," Verden said, rocking on his heels, hands behind his back.

"Boring, at any rate."

"I'll be frank with you." Leonard reflected that this was one of the least trust-inspiring phrases in the language. Surely the doctor knew that.

In trying to figure out why he'd said it, Leonard almost missed the frankness.

"What?"

"Please pay attention. This is very important. I said you are in grave danger of permanently harming your own mind."

"By resisting your efforts."

"By resisting therapy too . . . successfully, if you want to put it that way. It's a rare syndrome and I didn't recognize it, but one of the monitors—"

"He had a patient just like me, back in '93."

"No. He recalled a journal article." Verden took a folded sheaf of paper out of an inside pocket, handed it to Leonard. "Read this and tell me it doesn't describe what's happening to you."

It looked very convincing, a 'stat of an article from the July 1997 number of *The American Journal of*

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Behavior Modification Techniques. The title of the article was "The Paranoid Looping Defense: a Cybernetic Analog." It was full of jargon, charts and the kind of vague mathematics that social scientists admire.

Leonard handed it back. "This and two hundred bucks will get you the services of a typesetter, Doctor. Nice try."

"You think . . ." He shook his head slowly, ran his finger along the paper's crease and returned it to his pocket. "Of course you think that I'm lying to you." He smiled. "That's consistent with the syndrome."

He took the paper out again and set it on the table next to Leonard's bed. "You may want to read this, if only for amusement." Leaving, standing theatrically in the door: "You may as well know that there will be an extra monitor for your therapy tomorrow. A representative of the Florida Medical Ethics Board. He will give me permission to accelerate your treatment with drugs."

"Then I'll try to be very cooperative tomorrow." He smiled at the doctor's back and then laughed. He had expected something like this. But he was surprised that Verden hadn't been more subtle.

"You can't kid a kidder," he said aloud, folding the paper into fourths, eighths, sixteenths. He tossed it into the bedpan and turned on the cube.

It was the first time he'd ever enjoyed watching a quiz show.

As Leonard goes under the anesthesia he is very happy. He has a plan.

He will cooperate with the doctor, choose all the right alternatives, allow himself to be cured. But only temporarily.

Once released, he will go to a skill-transfer agency and hock his mathematics. He will bring the money to Verden, who has his original personality on file—*and buy himself back!* Audacious!

He awaits the first dream situation with smug composure.

Leonard is going under the anesthesia, very happy because he has a plan. He will cooperate with the doctor, choose all the right alternatives and allow himself to be cured, but only temporarily. Once released he will hock his mathematics at a skill-transfer agency and bring the money to Verden, who has his original personality on file and *buy himself back!* Audaciously and with smug composure he awaits the first dream.

Happily going under because he has a plan to be cured temporarily and sell his mathematics to get money to *buy himself back* from Verden, Leonard waits to dream.

Happy under plan cure *himself* dream. ■

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Violence on TV

Who's tougher—the violent barbarian, or the citizen who's surrounded with labor-saving machinery?

GLENN L. GILLETTE

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The house sat comfortably, held in its niche by the mortar of manicured lawns and fence-regulated boundaries. A large ranch-style station wagon added the required counterpoint. As similar as bricks, houses spread in all directions, each set at ease by its automobile statement.

Inside, Dan Rutledge turned away from his stereo, picked up his second martini, and walked into the kitchen where his wife Rita was fixing dinner. He ran a hand around her slim waist and she leaned into the crook of his arm. Dan scanned the planned mess of salad makings, and squeezed his wife again.

"What say," he said, "we finish dinner and go out for a show. And maybe stop in at the 'Fogbound' on the way home."

Rita turned, smiled as she stood on tiptoes, and kissed him. "I'd love to, honey, but you're forgetting Sean. He'll be due for another feeding about nine, and we really shouldn't leave him alone, at least not for another twelve years."

Dan made a face at himself and said, "We could get a babysitter."

His wife went back to slicing tomatoes and shook her head gently. "Not at this late hour you won't." She turned to see his back disappearing into the hallway. "But you can try anyway," she added, smiling. While she worked, she listened to the muffled clack of receiver and dial and the subdued words. After several short one-sided conversations, Dan came back into the kitchen.

"Sorry, dear." She took him into her arms, careful not to stain his shirt with her messy hands, and kissed him thoroughly. He returned the kiss but she could tell he was already scheming a solution.

"How long till dinner?" he asked predictably.

"About twenty minutes. I'll call your workroom when it's ready—or better, about five minutes *before* it's ready."

Dan thanked her and turned again into the foyer of the house. Just short of the front door, he opened what appeared to be a closet and clumped down into the basement. As he emerged below the rafters, his eyes turned left in anticipation of the plans brewing in his head.

The full basement was split in half by a careful demarcation of carpet. On Dan's side the floor was covered with heavy canvas and lit by bands of fluorescent lamps. Set at various points were table and jig saws and a tremendous workbench that offered electricity, gas and vacuum as well as easy access to a remarkable tool-storage cabinet. Above the workbench was a single shelf lined with a gamut of do-it-yourself handbooks. A product of Dan's own hands and mind, the workroom was clean and welcoming.

Weaving around the saws, Dan

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went to one end of the workbench and lifted from beside it a large square of finished plywood. This he hung above the working surface by matching half-hinges and leaned back until it became a drafting table. Pulling up a stool, his drafting kit, and several books on electronics and electrical engineering, he bent a questing eye and an experienced hand to drawing up plans.

Elsewhere in the same city, where old shambling buildings gathered around the rail yard, another room was cluttered with furniture. A patina of misuse covered the walls, making them one with the bare table and rickety chairs. They mirrored well the face of a middle-aged man who stirred about the tenement, unfamiliar with the furnishing and the noise of the city outside. He wore drab clothes that fit awkwardly on his haggard frame and when he walked finally to the single window, his carriage indicated that he didn't much care what he looked like.

The weak glare of the winter sun through the dirty pane was suddenly interrupted by the reflected sweep of the door. The man looked slowly over his shoulder at the youth who stood in the doorway, his face open with surprise.

"Hank!" The word wasn't quite a shout. The young man, slender, clad in the slick threads of "in" youth, stepped quickly into the room. "I wasn't expecting you—" he started.

The man turned from the window and briefly relaxed his grim nonexpression as his brother approached him. Then he screwed up his weak eyes and spoke as he looked around the room. "I was a good boy. They subtracted the good behavior and booted me out on parole. They must have too many Inside these days."

The youth stopped at the opposite corner of the table and in mutual embarrassment, they sat down. Hank carefully watched his brother, strangely more mature because of the intervening years. "Got any money, Mike?" he asked.

Shying a little in shame, Mike admitted that he hadn't. But when the young man raised his head, Hank read more defiance than shame. "Made any hits lately?" Mike's nod prodded an explosion from the older man. His face knotted into rigidity and both hands crashed to the table, raising his body from the chair. A flash flood of rage stole the presence from his eyes and Mike half-rose in fear.

Then, as quickly, a calm spread over the lined face and Hank sat once more. Waving Mike to his chair, he said firmly, "You're not going the way I did. When I was your age, I had a job, some dumpy job in a shipping department. It was so bad that I had to knock over gas stations to get the bread I needed. Small time stuff—but I

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worked my way up only to get busted—and started again—to get busted again—for a long time. Not this time. Not you. I want the dough and *both* of us are going straight to the big time.

"I've been working on a scheme that I think might work and make us some good bread." Hank paused in preparation and then went on. "Most kidnappers go for the big money when they hit. They cop some rich cat or his kid and ask for a couple hundred thousand. Trouble with rich cats is that they're tough or they wouldn't be rich. They fight back, with the cops, the FBI, whatever. Most snatches like that don't work at all. Lazy man's schemes.

"If you've watched things, you've seen there's a lot of money in the suburbs these days. There's some classy houses, expensive cars—the whole routine. And there's always some extra cash stashed away in a bank. But those people are soft. Not like us. They haven't had to work for a single thing in their lives. They're soft and not used to violence. Or hardship. The life most of us lead would kill them." Disgust tinted his words.

"OK, so we snatch a kid from the suburbs, some guy we know his bank account. Then we call him. Scare the bejesus out of him and tell him to stay away from the cops. Then we hit him for a little less than his savings, say three, five thousand.

"He's got the money. He's scared for the first time in his life. He ain't going to no cops. He forks over the money. We hand him back the kid safe and sound. No killing.

"And we keep doing it. The cops won't even know for the first few times what's going on. And they won't be able to get the suckers to come out in the open till it's too late. We run it slick and there's no way we can lose."

They noticed the cubish briefcase, then they saw the earphone, but first and last they were aware of Dan's secretive smile. They didn't want to release that self-satisfaction but their curiosity was unbearable. So three of his associates vented the bubble of silence.

"What is it?" they asked.

"I'm babysitting," he replied.

The conjunctive "huh?" was all he needed to unfold the case and display his wares. "Did all the research, schematics, and construction myself," he began as the three executives crowded around his desk to the tune of unsnapping latches. Dan was one of five management executives whose offices made up the departmental complex, and through the open door of his office, their mutual pair of secretaries sat in charge of the six doors that surrounded them. "Started it about three months ago," he continued as he set metallic tubes aside, "because I found out what it's like to

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be tied to the house all the time with the baby." Threaded collars whirled into place. "And fight the hassle of babysitters." He activated switches and verified lights as a hum began to tickle the bottom range of their hearing. "So I built this." He stood back, his hands spread like Houdini reappearing.

It was a square eye with arms, a multiple-amputee octopus, a cyclopean mantis appearing through the varnish of the desktop. Or—it really was a nine-inch (diagonal) black-and-white television screen with an expanded console of switches, knobs, and lights; two tiny mechanical arms fed into the bottom of the set.

Dan sat again. "I have a small, amplifying transceiver here in the set. In my car, there is a larger, more powerful transmitter-receiver that relays the signals between the house and this set. So when I push this button, it activates the TV camera in the nursery at home. I can operate in the infrared so I won't disturb the kid when I check on him at night, and of course, there is the normal visual range too." The screen had now stabilized, showing a crib in a mostly unseen nursery. The sleeping infant in the bed stirred, rubbing his nose with a pudgy hand.

"I have a large pair of 'hands,' the slaves, on a circular track on the ceiling—the camera is placed at their nexus." He gripped the shining protrusions in front of him, their small circlets of metal barely encompassing his thumb and first two fingers of each hand, and pushed gently. The edges of the screen began to pinch in until, abruptly, two large robotic arms with two-fingered hands reached down toward the baby. The others hardly noticed Dan's hands manipulating the master controls as they stared at the huge slave mechanisms approaching the crib. They slowly gripped its side, only to start it rocking smoothly. Dan released a finger, punched a button, and freed his hands to sit back, arms folded.

"It's on automatic now, though that is the only function the simple electronic brain can handle by itself. Here, I'll show you the rest of the room." He reached forward once more, engaging his hands and pulling the distant ones away from their repetitious task. The arms still extended, the camera began to circle the nursery, bringing into sight the various paraphernalia incumbent with a new child. "I can do all the simple chores, like fix a bottle and change a diaper, adjust the temperature and turn out the lights, you know, anything short of actually cuddling the kid. I can even break into my phone circuitry and call the doctor with this console. Rita and I feel pretty safe when we leave the house."

"Do you have to keep checking in on him to make sure everything is all right?" asked one of his friends.

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"Well, we do tune in to see how things are, about every twenty to thirty minutes. But, I have a microphone set up in the nursery so that any large noise, say above twelve decibels, will activate the equipment and send a tone into an earphone here." He tapped the side of his head. "Then I can turn everything on—I don't have to set up the arms unless I need to—and check to see what the matter is."

"Built it yourself?" asked another, raising his eyebrows to cushion the intrusion.

"Yeah," said Dan quietly. "I've been a tinkerer in electronics for years. Started when I was a shipping clerk for Smith Electronics. I made radios, burglar alarms, that stuff, from salvaged parts. Put myself through night school and then college by tinkering.

"Haven't been doing much since I started in the Rat Race." Dan flashed a smile. "So I'm happy with the way this turned out."

"Gonna make another, Dan?" And the conversation went on from there.

Hank bent low over the table, his arms spread in preparation. Abruptly, he brought the cue forward, smacking the ivory ball sharply. The ball rebounded from a cushion, nudged the twelve-ball into a corner pocket, and rolled to a stop in excellent position on the eight. Hank glanced through the smoke-clogged air of the bar at the wall phone and turned back to concentrate on the game.

All he needed now was the phone call from Mike and he would be able to flee this dive and get on with the snatch. It had taken five weeks of waiting and work for Mike to find an appropriate mark. Carefully groomed and performing his establishment role, he had muttered through his time as a bank clerk, unsure of the plan and uncomfortable in the straight atmosphere. But it had paid off, and now Mike was watching the house, waiting for the suburbanites to trundle their expensive car off to a show or something.

He collected the five-dollar bet on the game while the resentment stirred inside. *All the hard times I've had while those slobs with no brains and no bodies collect the dough for shoving papers around. Well, this time I'll take them, and I'll take them where and when it counts, close to the heart and a tickle away from death.*

The phone rang and the bartender called his name.

Tremendous colored images revealed themselves, so fast that the motion was coherent. Most of the people in the theater were only aware of the make-believe life on the screen, expelling all sensation of their actual surroundings in preference for the celluloid ones. In the lulls of action, though, Dan came back to himself and glanced

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through the dimness at the draperies and cushions and the people that decorated them. He was an observer, pent in the cool chamber of his seat, apart from the strangers that encircled him.

But his gaze would fall on the woman beside him, on the curling ebony hair that licked her pale cheek, and he was brought back into real space with the knowledge that this was his wife. His eyes would languorously trail over her profile, pausing occasionally, until he saw his hand in hers. Only then would he feel the warm softness of her and the sensation would draw his mind to the case, nestling against his left calf, and by inference, to their child. The three of them, united amidst the other independent entities. Then he would drift up the stream of light to the screen again.

Hank felt anonymous in the shadows of the almost abandoned house. His movements were cushioned by the carpeting and stillness. The nursery door, however, moved too quickly away from his thrusting hand. Before he could grab it, the door banged against the wall.

A mild tone sounded in his ear and Dan reached automatically for the handle of the case. As he pulled the box onto his lap, his mind came away from the visual enchantment and joined his body in its actions. He lifted the top of the case and folded blinders down to support it, forming a pocket to screen the light from the others. He watched as the bright white dot formed in the grayness of the tube and his pupils contracted as it became a picture. Even though the camera was now receiving in the infrared range, the image remained black-and-white, and Dan puzzled at the comforting picture of his child asleep. The sound that had activated the system was not heard and no other noises had greeted him in the moments it took him to erect the machine. Rita touched his arm inquiringly but he could only shrug in answer.

A squeak filtered through into his ear and his attention was pulled to the border of the screen where an image was growing. The intrusion of black became a man's shoulder, then his back, as he advanced stealthily toward the crib. His hair was covered by a knit cap and his hands were protected by gloves.

Dan stared in bewilderment at the scene and then took preparatory steps. He unfolded hangers from the rear of the case and hung it on the back of the seat in front of him. He assembled the mechanical arms and installed them in their slots.

"Dan, what is it?" his wife whispered. He folded back that blinder so she could see. The man on the other side twisted his head as the light from the screen painted across

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his peripheral sight. The teen-age couple behind Dan also glanced that way and then back to the film. "A burglar?" Rita questioned, slipping her earphone into place.

"I guess so." Dan talked minimally, concentrating on the image before him.

Hank was now bent over the crib, looking at the baby.

The man beside Dan elbowed his wife and they turned their attention to the wondrous gadget operating in their midst. Dan subconsciously felt hands pull against his seat as the boy and girl came up to stare over his shoulder.

Hank turned away from the crib and went to the left. The camera pivoted to follow his actions.

The movie was now forgotten in the nucleus of people centered on the Rutledges. Whispers conveyed information to interested spectators and attracted the attention of others away from the film world.

"Hey, mister!" the woman on the other side of Rita whispered. "Where'd ya get that thing? Yuk." An impatient wave of Rita's hand was meant to silence her, but she turned to the row behind them and continued: "What some folks won't do to get out of payin' a babysitter or watchin' the kids themselves. Fer God's sake, mister." She turned back, leaning across Rita. "I want t' watch the movie." Voices came from behind, though, vetoing her protest, touching on the remarkable mechanism now among them. People began standing to see what they could. Smiles and amazed comments spread.

Hank had found a traveling bag and was stuffing it with diapers and bottles of formula. He moved methodically but swiftly, soon zipping the bag closed and shoving it over his shoulder.

"Dan! He's taking our baby!"

Dan's grunt disagreed with her and he swung the small arms in front of him. The picture flashed off the man as the complex began to ride the tracks around the room, and then it seemed to freeze, staring intently at a ceilinged corner. Dan muttered as the control arms in his hands balked and, hastily freeing his fingers, he adjusted the remote camera.

"Hey! What's going on?" someone called from the side.

"A guy's in the kid's room!" another, closer, answered. The crowd pulled together to watch. In the dark, hands rested on shoulders and cheeks touched necks and arms. Everyone had to see.

Dan tested and found the slave arms once more unjammed; he spread his hands slightly.

Hank fought through the darkness trying to see something in the room with him, and as the great arms loomed, he looked up. He started and his right hand flashed to his waist.

The hand came back with something big, dead in the eyes of the

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infrared detector. Dan jerked his arms forward and the mechanical ones jammed. Dropping his eyes, he searched the console desperately and then dashed a finger at it. The lights sprang to life in the nursery and the kidnapper staggered back, blinded, flailing. Dan clamped mental controls on himself, and moving deliberately, slashed with his right hand. A metal claw smashed a waving fist, driving the gun from it.

A cry from the baby occupied the audio register immediately above Hank's scream of anguish. The wailing infant, however, drew his attention back to the more real world of the nursery and he flicked his gaze between the crib and the single TV eye. In the seconds of his indecision, everyone in the theater was rigid; the only nerves operating were the ones relaying the picture to brains. Hank moved, flinging himself toward the crib, yelling his frustration and fear.

Dan's hands surged forward and on the screen, the massive pincers of the remote arms opened and raced to intervene. The right one extended suddenly and the flicked hand caught at the man's shoulder, sending him reeling against the wall opposite. There was a pause as the arms rode the rails again, then the camera pinned the man to the partition.

"Rita, break into the circuit and call the police while I watch this guy." Breaths rasped in chorus with creaking seats as the audience relaxed from its vigil.

On the screen, the intruder crouched in the corner where Dan had just thrown him. He made a tentative move to rise again and Dan flung a mechanical hand in his direction.

Hank jerked back into a protective position. He felt captive, beaten—pinned down in suburbia by a ruthlessness that didn't belong here—but *was* here. He rose again, feeding his bravado with greed and frustration. But those arms kept at him, kept at him until he couldn't remember how long it had been, until he couldn't think anymore. Until he heard the howling of a police siren—again.

He muttered to the closing wail: "But they're supposed to be soft . . . soft, I said . . . soft." ■

The Analytical Laboratory/November 1973

Place	Title	Author	Points
1.	.....The Sins of the Fathers (Pt. 1)	..Stanley Schmidt	1.77
2.	.....We Are Very Happy Here	.....Joe Haldeman	2.10
3.	.....Epicycle	.....P. J. Plauger	2.97
4.	.....Regarding Patient 724	.....Ron Goulart	4.07
5.	.....The Sons of Bingaloo	.....Sonya Dorman	4.44

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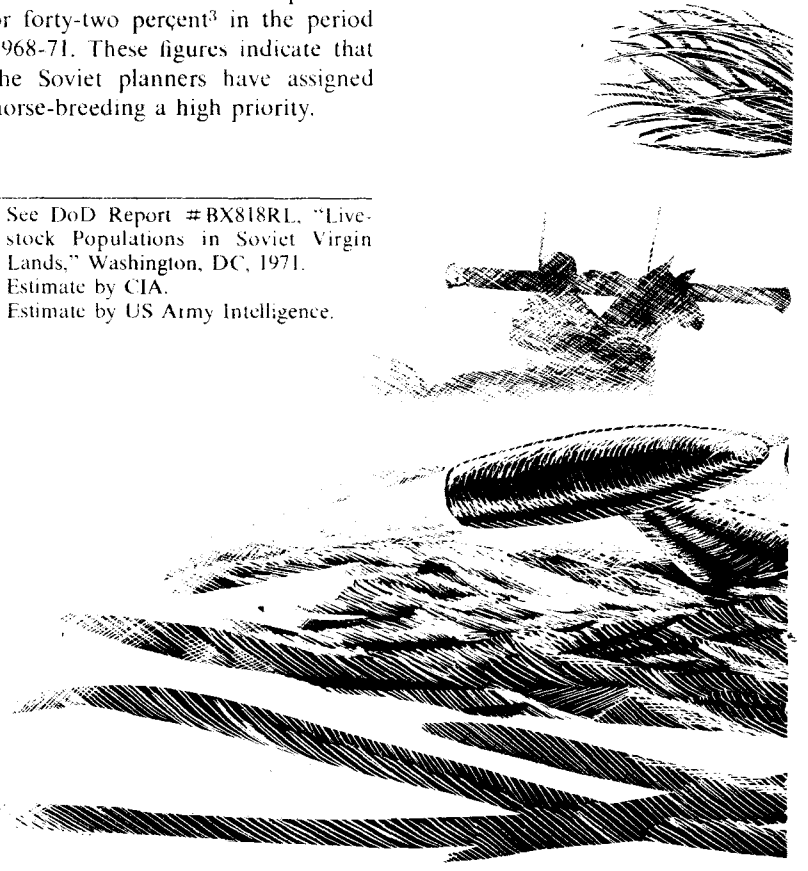
The Amphibious Cavalry Gap

J. J. TREMBLY
(Special Adviser, Naval Research and Development Commission on New Weapons Systems)
as told to JAMES E. THOMPSON

Military intelligence estimates of the enemy's strength and plans require two ingredients. One is logic. The other . . .

Intelligence reports coming out of Soviet Central Asia and Siberia indicate that the Soviets have undertaken an extensive horse-breeding program.[1] The number of horses in the USSR increased fifteen percent[2] or forty-two percent[3] in the period 1968-71. These figures indicate that the Soviet planners have assigned horse-breeding a high priority.

[1] See DoD Report #BX818RL, "Livestock Populations in Soviet Virgin Lands," Washington, DC, 1971.
[2] Estimate by CIA.
[3] Estimate by US Army Intelligence.



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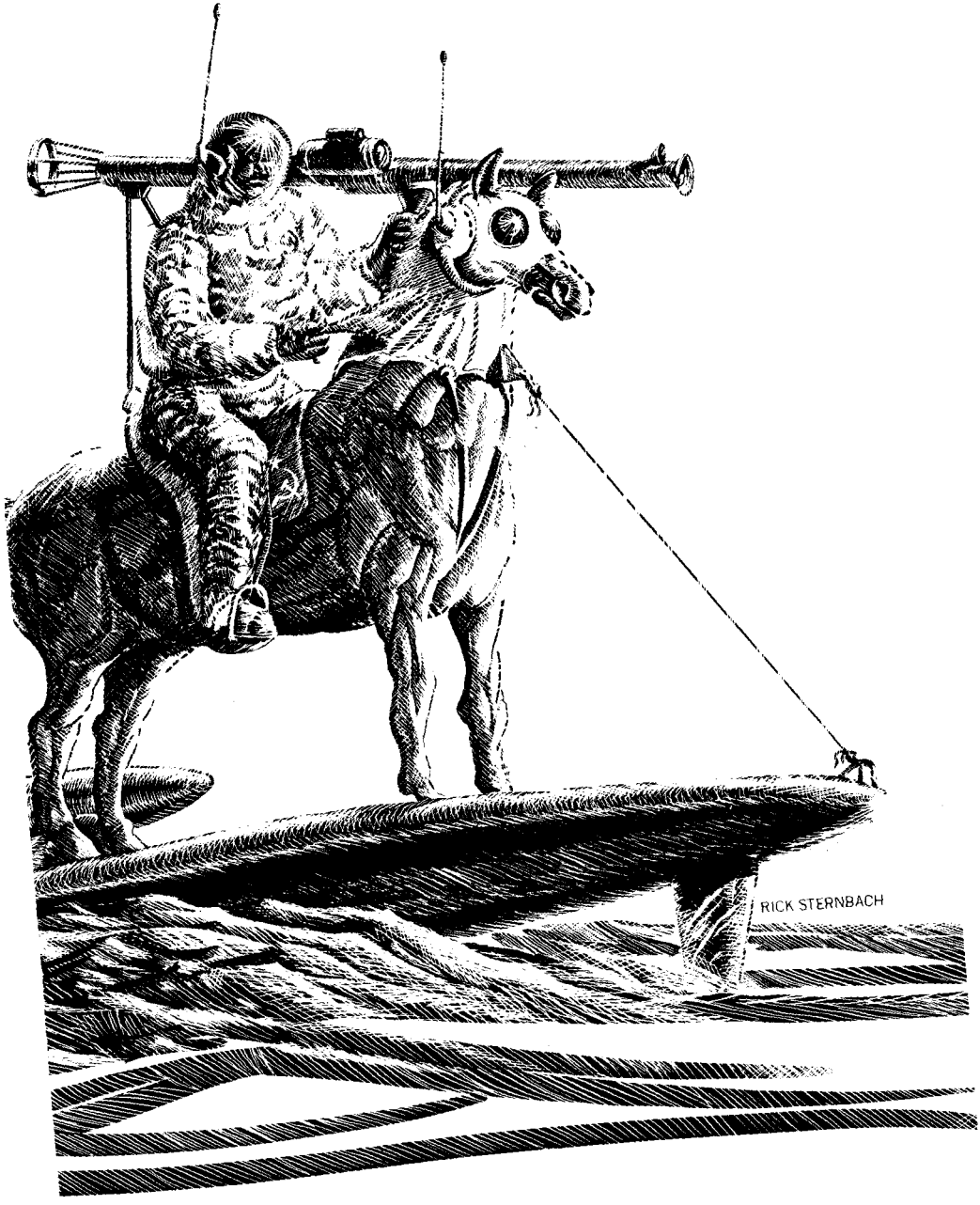

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The question now arises: What place does this crash program occupy in Soviet strategic thinking? Here we can only speculate; but, in the light of the Soviet Union's known expansionist aims, it behooves us to consider the possibility that they intend to use those horses against us.

Horses have not been used extensively in warfare since the outbreak of World War Two, when the Polish cavalry proved highly ineffective against German armor.[4] This has led to a consensus of military thought—that is, of Western military thought—that cavalry is obsolete. But can we afford to call cavalry "obsolete" when the enemy has not? The Soviet rulers are not talking about cavalry being "obsolete"; instead, as we have seen, they are breeding more horses.

Someone may object that Soviet cavalry cannot pose a threat to the United States, because the two nations have no common land boundary, but are separated by water; and it has been found that cavalry is effective only on land.[5] Cavalry could, however, be used against the United States by the USSR (or vice versa) if the horses and their riders were transported to the scene of combat by sea or air. If the horses are transported by air, this gives no obvious advantage to one side or the other, as all points on the Earth's surface are equally accessible by air; but if we think in terms of the horses being transported by sea, an ominous conclusion emerges. Let us list the most important cities in the two nations. In our case, this will consist of our national capital plus the four most populous cities; in theirs, of the five most populous, as their capital (Moscow) is also the most populous city:[6]

USSR	USA
Moscow	Washington
Leningrad	New York
Kiev	Chicago
Tashkent	Los Angeles
Kharkov	Philadelphia

When we look at the location of these cities on the map, we find that only one of the key Soviet

[4] Guderian, Gen. Heinz: "Panzer Leader," trans. C. Fitzgibbon. New York: Dutton & Co., 1952, pp. 65-84.

[5] See, for example, Exodus 14:26-30.

[6] According to population statistics from the 1972 World Almanac.

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cities—Leningrad—is located on the sea, while four of the five key American cities are located on the seacoast or very near it—New York, Philadelphia, Washington and Los Angeles. (And even Chicago might be accessible by sea, via the St. Lawrence seaway.) Therefore, we are at least *four times* as vulnerable to amphibious attack as the USSR. When one considers that they also have more horses than we do, the seriousness of the amphibious cavalry gap becomes apparent.

If the horses are to be transported by sea, it must be either by surface ship or by submarine. We can, I think, rule out the use of surface ships, for submarines have the advantage of concealability; if the horses were transported on the decks of surface ships, they could be detected by our sky-spies. So if the Soviets are planning a sneak amphibious cavalry attack on the US, they will almost certainly use submarines, and will be building a larger submarine fleet. This, we find, is precisely what they *are* doing. The Soviet Union now has 401 submarines to only 152 for the United States.[7]

[7] "Jane's Fighting Ships," 1971-72 ed.

Is there any hope of overcoming the disparity between our military capacity and that of the Soviets caused by our greater vulnerability? In my opinion, there is such a hope; but it can only be achieved by the creation of a greater total striking force proportionate to the enemy's greater invulnerability, that is, four times as many horses, four times as many trained cavalrymen, and four times as many cavalry transport submarines. In the field of submarines alone, this means that, as the Soviets have 401 usable submarines, we need 1,604. Given that our present submarine strength is only 152, we need 1,452 more submarines, to be fitted for cavalry transport, for an adequate defense.

It is urgently necessary that we begin at once to close this gap. The Defense Department should immediately make known the seriousness of the threat, and demand that Congress vote the necessary funds.

Some persons have suggested that a weapons system of the type described poses no real threat; but an experienced submarine commander has assured the author that a cavalry-carrying submarine would be, in his words, "a real *stinker*." ■

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Wet Blanket

Many men have tried to save the world.
The ones who make out worst are the ones who succeed.

P. J. PLAUGER

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JOHN SCHOENHERR

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He awoke to fear and a conviction.

Blood pounded and bowels writhed in the icy grip of an unknown terror. He would have cried out—he was alone, there was no one to hear—were it not for a lifetime of discipline.

That discipline had an iron fist of its own, aided by a decade of training and drill. Almost before he was consciously aware, the new grip was applied. Respiration slowed, blood pressure dropped, heartbeat came down to eighty . . . seventy . . . a fast sixty beats per minute. Fear melted into calm.

Fred Hahnemann opened his eyes to the morning sunshine. Birdsong and the soft splashing of water blew into his bedroom and touched his still damp forehead with cooling reassurance. It was going to be a beautiful Indian summer day.

The familiar room echoed the encouragement of woods and water outside. Clothes laid out for the day on a spartan valet, a sunlit worktable in one corner, and on it an open journal.

An open journal.

Answering the summons, Hahnemann threw off the sheet and levered himself erect. Cold bricks stung his bare feet as they left the throw rug behind. He wiped gummy residue from the corners of his eyes and stared down at the book, left open at last night's entry.

He picked up a fountain pen, uncapped it. Ignoring the words already on paper, he drew a bold horizontal line, entered the date beneath it and wrote:

"The universe is bistable."

The sentence looked silly, sitting there all by itself, but he had nothing to add. At least not yet. The statement was ludicrous; its presence in the journal of an eminent theoretical physicist could prove embarrassing.

But Hahnemann, Leslie W. Stamford Professor of Physics and Astronomy Hahnemann, gave little thought to that. The journal—and its eleven older brothers locked up in his files at the university—already contained numerous entries that once were equally laughable. A few weeks, sometimes a year, of hard work had changed each of those jokes into jargon.

The Hahnemann Effect, Hahnemann-Lee Quantization, the Hahnemann-Einstein Equations were the names by which his colleagues paid tribute to those diamonds in the rough. A good analogy, that. For they were mined from deep within his subconscious, then polished at this very worktable, or in the maw of a computer, or even in the rough and tumble of the laboratory.

And always there was a conviction. Long before sense or reason had their innings came the inner certainty that each lump was indeed a gem of truth. Training saw to that, discipline insured the follow-through—permitting his conscious personality to enjoy the

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riches cast up by his ever-probing inner mind.

But never before had there been fear.

He straightened up from the table, realizing that he had been staring through the fresh journal entry, in the hope, perhaps, of seeing beyond its bald beginnings. No, that must come in its own time.

The thought of breakfast tugged him away from his fruitless probing. Yes, fruit, that was what he wanted. Bananas and wheat germ, milk from a stone crock in the springhouse. An apple while sitting on the rear stoop, contemplating a bold cardinal come to visit him in his little clearing and share his bubbling waters.

Then on with clothes and, leather-bound book tucked securely into the front basket, onto his bicycle and off up the path to the road. The routine of climbing hill and diving through vale almost charmed him, but his thoughts kept coming back to his new-found conviction. And that gut-wrenching fear.

The campus was just stirring to life as Hahnemann coasted up to the physics building. A black squirrel watched from an oak limb as he threw open his office window and turned on his desk lamp. There was work to be done.

The universe is bistable.

It still seemed like nonsense, but it was all he had to go on. Gravity must be the culprit, for no other force shaped the universe quite so firmly as that weakest of forces. Weak, but permeating the farthest reaches—giving space shape and time meaning that even the nuclear and electromagnetic forces must acknowledge.

"Bistable" meant two different levels—energy levels. And it meant the existence of an interaction that could cause an energy difference, remove a degeneracy and split two otherwise identical configurations into discernible entities.

But where was there a degeneracy that could be split? Hahnemann knew general relativity, better than most men knew their own desires. He had even added his bit to the lore of Einstein, and Dicke, and Wheeler—a small bit, by his standards, but still no mean contribution. If there were a degeneracy in the equations of space-time physics, he should know about it. Or his subconscious, he reminded himself.

That much decided, he settled down to work, scouring the basic derivations in search of the mathematical key to a physical lock faith told him existed. He didn't find it by class time, and had to withdraw from the cosmos long enough to preach Maxwell's laws to a band of indolent sophomores, who had already succumbed to the torpid weather.

Nor did he find it by dusk, as he pushed his way up the first hill on

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the road home. It was not, in fact, until five days later that he found it—and it was not until after three days of checking had gone by that he believed it. But the universe was, indeed, bistable. And he could find nothing to fear.

It was such a small thing, laid out there on the pages of his journal. Small and yet so profound. Dicke had measured the effect to—what was it?—ten decimal places, and found it null. Hahnemann's calculations showed it up as a part in ten to the thirteenth. Such a small energy splitting, probably not more than ten joules for the entire mass of Earth. Maybe too small to measure.

Now *there* was a challenge. For what was the good of discovering an effect if it could not be measured? The philosopher in him found such a state of affairs repugnant; the physicist in him took up the gauntlet. What he needed was an interference experiment.

If the effect you wish to observe is swamped by an enormously larger one, then you arrange for an equal but opposite effect to cancel all but the signal of interest. It was a trick used by every experimentalist since Galileo.

He scratched his ear with his pen—better watch that, it was getting to be a habit—and tried to think in terms of interference phenomena. The application in this case was not going to be obvious, not if Einstein had missed it. He stared at the sepia photograph of the great man on his office wall and remembered his dictum:

"God is tricky, but He isn't mean."

That brought forth a smile, then a frown of concentration, capped by a shrug. It was going to mean more work. But not today, for the light was fading and the short autumn day must soon come to an end. He took his journal home with him that evening.

By next morning he had it, and since he had no class that day he sat at home and wrote feverishly until well after noon. Then he packed a knapsack with food and his precious book, and set off for campus and a night at the computer center.

Dawn light seeped into the sterile confines of the data preparation room as Hahnemann stared in awe at his final printout. He had traced the full effects of a transition between the two stable states—that ten-joule difference for the Earth—and he was impressed.

The speed of light would remain unchanged, Planck's constant would alter imperceptibly. The light elements would continue to solve Schrödinger's equation the same way as ever before. Only certain properties of the heaviest elements would shift noticeably. A Q-value here, a few cross-sections there.

Hahnemann stared through the slats of a venetian blind at the new day being created outside and pon-

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dered. He knew what experiment to do now, and what effect to expect. He could flip the universe into its second state, at least in the neighborhood of this planet, and prove to the world that he had done it. But it was a one-way trip—he could not flip it back.

Why do it? Why fool with the way things are just to demonstrate your virtuosity? But then, why not? If I publish, some meddler is sure to try it if I don't. No, that's not reason enough.

Yet the effect was still so small. A Q-value here, a few cross-sections there. And only among the heavier elements. The heavier elements. Like uranium and plutonium. He reached for a coding sheet, even though he already knew the answer.

The ready room was bustling with the day's activity by the time he had the verification he expected. He sat sipping a cup of rancid vending-machine coffee and rubbing his weary eyes. He had a lecture to give soon.

Months later, looking backward to this time, he was proud that he was able to make the right decision then. Overdue for sleep, bone weary and pressed for time, he still did not succumb to the temptations of delaying or pretending to share a responsibility with someone else when it was his alone.

He would need a superconducting magnet, and the heavy ion beam from the accelerator, and a CW laser. He reached for the telephone, ignoring the memory of fear.

The smell of rubber cement whipped about his nostrils. Hahnemann sat on a stool beneath his favorite oak, playing tug-of-war with scissors and a windblown *Times*. Other clippings sat under rocks, straining to fly free, on his outdoor worktable. It would have been much easier to go inside, but he hated to miss one of the first golden days of spring.

A leaf impishly landed on the freshly daubed page of his journal, perhaps hoping to usurp a place in history. Perversely, it stuck to his gummy fingers as he tried to send it on its way. He stepped on it with mock severity and pulled free. He wasn't very good at this sort of thing.

His journal was beginning to look like the scrapbook of some Broadway aspirant instead of a sober scientific record. Still, data was data, and if his latest exploits touched on politics and reportage, then newspaper clippings were a necessary form of documentation. He imprisoned another article, then paused to read:

ITALIANS DELAY A-TESTS
Special to the New York Times

Milan, April 17—The Italian Defense Ministry has decided to "postpone indefinitely" its proposed series of mid-Pacific atomic tests, a

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government spokesman announced here today.

Citing a "renewed interest in the moral principles surrounding atmospheric testing," the official announcement called for a return of the atomic expeditionary force until "such issues are better resolved."

The spokesman refused to comment on the possibility of Vatican intervention leading to the decision.

* * *

CORRIGENDUM
(Received March 27)

January Physics Review Letters: "Evidence for a meta-stable isotope of element 116," by A. D. Frank, *et al.*, page 83. The second sentence in the third paragraph should read ". . . was measured to be 11.9 picoseconds within the error stated above."

* * *

EARTHQUAKES TAKE A VACATION

April 30—It seems that even planets hibernate sometimes. So says earthquake-watcher Charles Winston, research assistant at State's nearby Midway campus.

"This must be the quietest winter in twenty years, as far as geological activity is concerned," says Winston. For evidence he displays a strip-chart recording nearly seventy feet long with nothing on it but a ho-hum straight line.

Winston got ruffled when this reporter suggested that his seismometer might be suffering from a pulled plug. "We can detect a fifty-kiloton underground blast in Siberia, or count the number of locomotives when a Central freight goes through."

But the switchmen over at Central have been on strike since October. Maybe old Mother Earth decided to join them. How about it, readers?

* * *

To the Editor:

We wish to protest the continued shutdown of the Oak Ridge Fast Breeder Reactor. Director Rawlinson must be made to realize that he is a civil servant paid to perform administrative duties for the nation's scientists, not some Exalted Keeper of the Flame.

The high-handed way in which he terminated work in progress last Thanksgiving weekend cannot be defended, as he insists, "on the grounds of safety, pure and simple." The procedures he condemns have been standard reactor practice for twenty-five years and the violations he refers to are wholly unsubstantiated.

Yet this martinet has succeeded in keeping an important government installation inoperative for nearly four months, with no avenue of appeal and no prospect for relief. As scientists, we condemn this bureaucratic interference, and as taxpayers we call for an accounting.

* * *

PRAYER STOPS FALLOUT
by Sister Aretha Smith

March 10—The power of Chris-

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tian prayer has been keeping America under "a heaven-sent umbrella," Bishop Martinez told an estimated five thousand believers at an All-Souls Rally in Philadelphia's Fairmont Park last Saturday.

"Since the Devil first tempted our Australian brothers to stray from the Test Ban Treaty last year, we have maintained a continuous Pray-In of fifty brothers and sisters, around the clock, day and night," the Bishop said.

"As others fell by the wayside, we prevailed. As the dark rain fell on the hillside, we prevailed. And there have been no new tests to foul God's temple in a hundred days! Yes, brothers, the Devil fell on his backside because we prevailed!"

His remarks were greeted by cheers.

The rally was organized to raise relief funds for victims of last month's South Street police raids.

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Reprinted from the Soviet Journal of Physics (JETP). V. I. Vyssotsky, "On a Possible Weak Coupling between Nuclear Strong Force and Gravitational Radiation" (Available in December).

* * *

MAN ABOUT WASHINGTON
Everett Roper

The talk at the big, and I mean BIG, parties these days is all about the remarkable leadership The Man has been displaying in the current nuclear arms buildup. We all put President Clinton in the White House because we knew he was a no-nonsense kind of guy, the kind we need in these troubled times. And he really came through with a defense posture second to none.

That's why we're all so proud of his restraint in not resuming atmospheric testing just because every third-rate piece of real estate that calls itself a nation has been making a bid for entry into the A-club. So much for the bleeding-heart liberals and all their dire predictions!

What really impresses me about The Man is that he hasn't tried to take an inch of credit for the moral pressure he's brought to bear on the Johnny-come-latelies. No sir, when you think about it, that takes more guts than any mealymouthed preacher ever showed. It's good to know we have a President who can keep his mouth shut and carry the biggest stick of all!

* * *

Session FC. General Relativity (Main Ballroom, 9:30 A.M.): Invited Papers

F. I. Hahnemann, "A Second Solution to the General Field Equations."

R. W. Frankel, "Stellar Collapse Below the Swarzschild Limit."

A. B. Locard, "Black Hole Clustering."

A cooler wind rustled the page as Hahnemann read the last entry. But the chill struck deeper than it

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should have. It would be a delicate piece of business, giving that talk next week. He knew his talents did not lie in the direction of public relations.

It would be necessary to cover a lot of theoretical background, enough to convince the experts that there truly was no going back. And yet he must pitch the message in simple enough terms that the science reporters could get a glimmering of the profound underlying truth.

Someone in the room *must* catch the import of his remarks, before he had to spell out every detail. He began to appreciate how a comedian must feel when he loses his straight man.

It was going badly.

The room smelled of damp wool and too many people, for the hotel ballroom was filled to capacity despite three days of steady rain and freakish cold. He clutched the control wand in a sweaty hand and barely remembered to thumb the slide advance button. His pulse was up higher than he should have permitted and he could not quite ignore the cold metal band of the throat mike as it rubbed against his skin.

Gamely, Hahnemann launched into the concluding sentences of his talk. The silence in the room was deep, remarkably deep for such a large crowd. He wondered as ever whether it was respect or opacity that kept so many people quiet. His teaching experience inclined him to the latter view.

But the moment was past when he should have injected his real message, long past when his hoped-for interruption should have occurred. He let the talk run down and stop like a spent top. His shoulders sagged; he had lost. Then the thunder hit.

It took a full two seconds for him to realize that the barrage was applause. But here was the chairman smiling broadly and reaching for his hand. On the floor of the ballroom, chairs were scraped back as his peers stood to pay him enthusiastic homage. Maybe it wasn't as bad as it sounded to him.

"The chair will now accept questions for Professor Hahnemann." The chairman had to bellow his message twice before it punched through the din. A hundred hands were high. But the man knew how to run this business—deftly he picked out Abramowitz from the mob, the eldest statesman with his hand up.

"I was wondering"—the preliminary tremolo quickly brought a respectful hush—"if you have given any thought to the possibility of forcing a local transition to the state you so excellently describe. And have you explored the effect of such a transition on nuclear reaction rates?"

Trust Abramowitz to see right to the core of the matter! Hahnemann

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felt a surge of affection for the aging scholar.

"I'm glad you asked that question," Hahnemann said with a smile. Several knowing laughs chimed through the hall.

"The effect of the coupling term varies, to first order, logarithmically with atomic mass," he said. "So one can appreciate the difference only among the heavier elements. As an example"—he paused, then plunged on—"the fission cross-sections for plutonium isotopes are reduced by the factor alpha shown on the last slide."

A buzz started near the front and rapidly swelled to all corners of the hall.

He waited for the noise to subside, then proceeded.

"Some evidence exists that the second state occurs naturally from time to time. Professor Frankel"—he gestured toward the next speaker, sitting in the front row—"has published some very careful measurements of heavy-element distributions in third-generation stars." Frankel stirred uncomfortably, he knew what was coming.

"His data show clustering about two different equilibrium distributions for main-sequence stars. The difference was small enough to justify averaging all the data together, but my preliminary calculations call for a difference of the order observed between the two clusters. I would venture to say, therefore, that thirty percent of the stars Professor Frankel measured are already in the second state I described." The noise swelled up again.

"As to your first remark"—Hahnemann cut through the buzzing—"yes, it is possible to stimulate a transition by the rather obvious use of a coherent light source impinging on a beam of polarized heavy ions."

He had everyone's attention now.

"Coupling through the local gravitational field creates a cascade of incoherent transitions releasing approximately ten joules, mostly in the form of gravitational radiation. Unfortunately, because the transition is incoherent, there is no way to organize a resonant absorption having the necessary spin and energy, so the inverse transition is not possible."

The buzz returned and quickly became a roar. Through it all, Hahnemann watched a heavyset individual in a blue serge suit elbow his way down the center aisle and up to the podium. To everyone's surprise, he snatched the microphone from the chairman's hand and whistled shrilly into it. The chatter was promptly quenched.

"Sorry about that, folks," the man said to the crowd. Then, turning to the rostrum, he introduced himself. "Jack Weston, free-lance science writer. Now, I didn't follow all of that, but I got enough to know it's important. In words of one syllable, Dr. Hahnemann,

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would you please explain to us chickens just what you're driving at?"

"I'll try," Hahnemann ventured. *Here it comes.* "Put simply, there are two sets of laws our universe can obey, depending locally on which state it is in. These states are almost identical, except for the behavior of a few heavy elements."

"You mean like in atomic bombs, Doc?"

"Yes, like in bombs; but even some reactors are affected. In one state fission bombs work, in the other they fizzle. Of course, a fusion bomb could still be made, in principle, but in practice all H-bombs are triggered by fission. Controlled fusion is just coming into sight, and I don't know of any prospects for obtaining the uncontrolled fusion needed to produce a satisfactory bomb."

"And you can get us to the fizzle state, but not back?" he persisted.

"Not any more," Hahnemann replied. "I forced the transition last November 29, at 17:53 GMT. We're there. There hasn't been a nuclear explosion since. And I can't see how to make one happen ever again on Earth, even if I wanted to."

Pandemonium.

The room was warm and cozy. Weston steered Hahnemann skillfully between tables to the short leg of the L-shaped bar. He gave an efficient wrist flip to the balding bartender, who replied with a raised eyebrow and a nod. Weston eased his bulk onto an upholstered stool.

"You look like a Scotch man, if I'm any judge." Hahnemann inclined his head in agreement. "Swell. Harry, two of my usual, on the rocks. The stock here will rot your liver."

Harry ignored the slur and reached for the square bottle. Weston resumed his friendly, but thorough, probing.

"Tell me more about this Rheims Institute you went to, Doc. Even in my trade there are some things it's not easy to find out about. All I know is, you Rheims graduates seem to be setting the world on its ear; but I don't believe the public hokum about supernormal mutations."

Hahnemann smiled. He recognized the last thrust as a none-too-subtle attempt to draw him out by defending himself. Still, he was happy enough to help this man with his story.

"There are no dark secrets at the Institute. That's why most people don't believe the results, I guess. Charles Rheims simply discovered a few ways to help one's subconscious mind solve problems, which it seems to want to do anyway.

"It's something like peristalsis," he continued, "where your stomach and intestines keep grinding away at processing food, whether you think about it or not. We learn to

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avoid the mental equivalents of acid indigestion and starvation, to stretch the analogy as far as possible."

The drinks appeared before them and both men reached for wallets. The bartender stopped Hahnemann with a jabbing finger.

"Say, ain't you the guy that queered the H-bombs? Your mug's been on TV like a test pattern all day."

"Pardon me," interposed Weston. "Dr. Hahnemann, meet Harry, best barkeep east of the river. Harry, Dr. Hahnemann. He's the guy," he ended simply.

Hahnemann didn't know whether to extend his hand or run, as Harry continued to fix him with a speculative stare. Finally, the bartender spoke in a neutral tone.

"My wife, she's been afraid of this city since we moved here twenty years ago. 'They're going to bomb us in our beds, Harry,' she always used to say to me. I tried to explain all this deterrent stuff, how it's important that we gotta stay strong, but she wouldn't listen. She's still scared."

He stared through the physicist a while longer, then suddenly snapped into focus.

"Your money ain't no good here, Doc." Hahnemann started to rise, then realized that the bartender was holding out a gnarled hand. "It's a real pleasure. You just keep puttin' 'em down and Old Harry will keep settin' 'em up. That even goes for your fat friend, here."

Hahnemann breathed a sigh of relief and settled back onto the stool.

"You'd be surprised how many people are thinking like Harry these days," said Weston. "That 'America First' wave that swept through the elections is pretty well spent. Though some people haven't got the word yet." He shook his head in disgust. "Being top dog feels great until the rest of the pack starts tooling up to cut you down." A shrug.

"So if you give everyone enough time to think this business through, you should expect no trouble," he added, "at least from the man in the street. But The Man may be another story. He's made no announcement so far, but—"

"I'd like to buy the next round, if I may," the soft voice interrupted like a whispering of pines. And she stood there like a pine, lithe and lovely, gray-green eyes contrasting autumn-brown hair. She was clearly no pussycat, but Hahnemann reflexively stood up. He barely noticed Weston doing the same.

"You don't remember me, of course." She cocked her head wryly all the same. "Physics 417, five years ago, next-to-last row. You gave me an A-minus." She grinned. "Linda Parnell, Professor."

For the second time in five minutes he found himself shaking a proffered hand in perplexity. He

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had a vague memory of that class, his first assignment on leaving the Institute. Nervousness had kept the group a hazy blur for most of the term. But he recalled the alert eyes, the hair in a bun over the perennial sweatshirt and jeans. That was a girl and this was a woman, but the visions merged.

"I trust your knowledge of Clebsch-Gordon coefficients has improved," he finally replied. It was just luck that he recalled grading her final exam, marred only by her inability to normalize wave functions.

Her laugh came from deep inside.

"You do remember." She touched his arm as she sat down between the two men. That touch was an altogether pleasant familiarity.

"It's *Doctor* Parnell now, thank you. Despite the math. I just presented my thesis results yesterday. But I think you stole my thunder this morning. That was a beautiful presentation."

"Dr. Hahnemann was just telling me about his training at the Institute," Weston interposed. He wanted to get his exclusive interview back on the tracks. Deftly he skidded his untouched drink in front of the woman and waved to Harry with that efficient gesture of his. "I expect you'd be interested too."

The man was good, Hahnemann admitted. He found himself outlining his own very special approach to the PhD, as practiced by the followers of Rheims.

"But the real essence of our success," he concluded, "is discipline. It doesn't matter how many bright ideas you get if you don't do your homework. Just plain hard work is the foundation of the Rheims approach. That's not generally stylish, so people prefer to make up stories about us."

They sat quietly sipping awhile.

"But what about the fact that you never marry?" Weston resumed. "That can't help but cause talk, you know."

Hahnemann shrugged.

"If you pick a bunch of twenty-one-year-old scholars, who are already loners by nature, then separate them from society for five years of intensive training, you can't expect to produce social butterflies. It's not that we don't want to marry; we're just not good at hunting.

"Besides, the Institute has only been turning out graduates for eight years. And we've all been kept pretty busy. Sooner or later some of us will slow down long enough to look around. We really aren't supermen, you know."

That last was aimed at Weston, but it was intercepted by gray-green eyes. He found himself rewarded with a warm smile and another touch. He felt dizzy.

Hahnemann was surprised when

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Weston slid off his stool and looked at his watch.

"Hate to miss out on the free booze—Harry is seldom such a soft touch—but I've got a living to earn. Thanks for giving me the inside, Doc. I'll do right by you, count on it."

He hesitated.

"Y'know, there's going to be reporters hip deep in the lobby of your hotel, waiting for you to make a show. I'm not just telling you that to beef my exclusive."

Hahnemann had already considered that very fact, but his mind was too numb to grapple with it. If only he could escape quietly back to his haven in the woods.

"Don't worry about Professor Hahnemann." The soft voice had a touch of steel in it. "I'll see that he's left alone." Now, was that stance maternal, or friendly, or something more?

"Uh, yeah, I'm sure you will." An uncertain pause. "Well, good night, folks, and thanks again, Doc." He sailed off among the tables, a steamboat passing between sandbars.

Silence remained in his wake.

"I have an apartment here in town," she finally ventured. "That is, I work here. So I live here. I mean . . . I don't mean to be presumptuous, Professor, but . . ."

Her uncertainty reduced her to human proportions, in Hahnemann's mind, and overcame his own built-in reticence. Besides, his natural kindness urged him to ease her embarrassment.

"The name is Fred," he said with a smile, "and I'd much rather go with you to your apartment than sit here and drink—or face another mob today. Anyway, we have five years of catching up to do."

Harry was happy to call a cab for them.

The lights were painfully bright. Red eyes glowed in the darkness beneath the glare, impaling his sweating, squinting image on ten million screens around the country. Across the light-swept arena, eyes angry and fearful stared back at him. Linda was lost somewhere in the surrounding gloom.

They had had three glorious, carefree days together, exploring the city and growing closer. But inevitably he was spotted, cornered and forced into this television confrontation. Gallup and Harris had yet to announce the National Mood; the White House was keeping quiet. But those men behind that long desk over there didn't like him, that much was already clear.

"Now, Dr. Hahnemann," Everett Roper began again, making the honorific sound somehow derisive, "would you please explain to us by what authority you claim the right to experiment with a whole planet and compromise the security of your native land?"

Hahnemann sighed.

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"I'm not sure which of those charges you consider the more serious." No, that was the wrong thing to say—mockery was wasted on this buffoon. "But in all honesty, I can't see where I've done either.

"Please don't interrupt. I was not 'experimenting' in the sinister sense you imply—I knew exactly what I was doing. And I've hardly dented the United States' arsenal, since over eighty percent of it is non-nuclear conventional weaponry, or so I'm told.

"On the contrary, I seem to have ended the Chinese and Soviet threats for quite some time and rendered the ABM network unnecessary. That should save us all some tax money."

"So you say. But who gave you the *authority* to meddle in this business," Roper persisted.

"The Treaty of Nuremberg." He was ready for that one. "I felt I was responsible for the consequences of my actions, regardless of the lesser law of the land."

"Professor Hahnemann"—that was the unfortunate Frankel, who had lost his audience at the meeting—"it still seems to me that you were taking quite a chance by manipulating an unknown force with such far-reaching effects. As a fellow physicist, I can hardly condone your actions." And as an adviser to the AEC on military uses of science, Frankel was in no position to condemn, Hahnemann thought.

But what he said was, "The effects could hardly be called 'far-reaching'. Only a fraction of a percent of the atoms in the universe, or any one solar system, are heavier than iron. It takes an unnatural concentration of very heavy elements, such as the refined plutonium in a bomb, to even show a difference in behavior.

"And the force was far from unknown. It was your data on stars, Professor Frankel, that convinced me the transition could be safely made." That must have been what really bugged him. "If the effect was that small in the intense gravitational field of a star, then a change wasn't likely to affect life processes. In fact, the transition might have occurred spontaneously any old time. I just egged it on."

"Dr. Hahnemann"—this from Bayard King, a weasel of a man with a reputation for deadly indirection—"is it true that you live in a house with no running water, no electricity and no telephone?"

Watch it!

"Not exactly. There's a very pleasant spring just above the house that gives me all the running water I could wish for."

"But you have no indoor plumbing?"

"No."

"Electricity?"

"No."

"Telephone?"

"No."

"Do you drive a car?"

"No."

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"How remarkable." His tone did not find it remarkable. "An eminent *theoretical* physicist, a *tenured* professor"—each emphasis implied *demented*—"sitting out in a shack in the woods deciding national security policy. This is indeed the Era of the Common Man!"

"The house is stone and over a century old. It hardly qualifies as a shack." This was really too much. Couldn't these idiots see the real issue at hand? Next they would be going after his sex life.

"Are you married, Dr. Hahnemann?" asked another panelist, gazing off in the direction where he had left Linda. That did it.

"That does it!" The stool crashed behind him as he stood and a camera lurched forward to capture his angry features.

"Hasn't it sunk into any of your skulls what this discovery meant last fall? On one day, it could be business as usual, bombs blossoming and pilots singing. On the next, or just twenty minutes later, before the retaliatory strike arrives, it could be 'Sorry, no more bombs accepted.'

"Can you imagine the temptation of having a weapon you can use only once, but one that properly employed could give your side global superiority ever after? How big a first strike would you order to make sure of the outcome? How many deaths is enough? And who would you count as a friend to be spared? Are you sure?"

He was trembling. Linda appeared beside the camera, wreathed in concern. Hahnemann forced the iron fist of control over his heart, his lungs. He continued softly.

"This nation of ours, this marvelous symbol of self-determination, has invaded seventeen countries in the last decade. Congress declared war on none of them. The current administration has already intervened in the internal affairs of three sovereign nations, all in the interest of 'protecting American lives' that were never threatened.

"No nation has declared war on us in nearly forty years, and yet we have a *defense* department so huge it essentially runs the country. And militarism is once again a rising tide throughout the world. Are these the people to whom I should turn for a decision?

"No, I cannot trust the Pentagon—I could hardly trust myself with such power of life and death. Nor could I hope to keep it a secret, for secrets leak out, or are independently discovered. And if I can't trust my own nation to exercise restraint with this power, how could I possibly trust another?"

He paused. They were finally getting it. Finally.

"You are acting like a bunch of children caught playing with fire. To you it's just another sparkling toy. I put a wet blanket over your pretty blaze and now you're mad at me. Well, you still have plenty of

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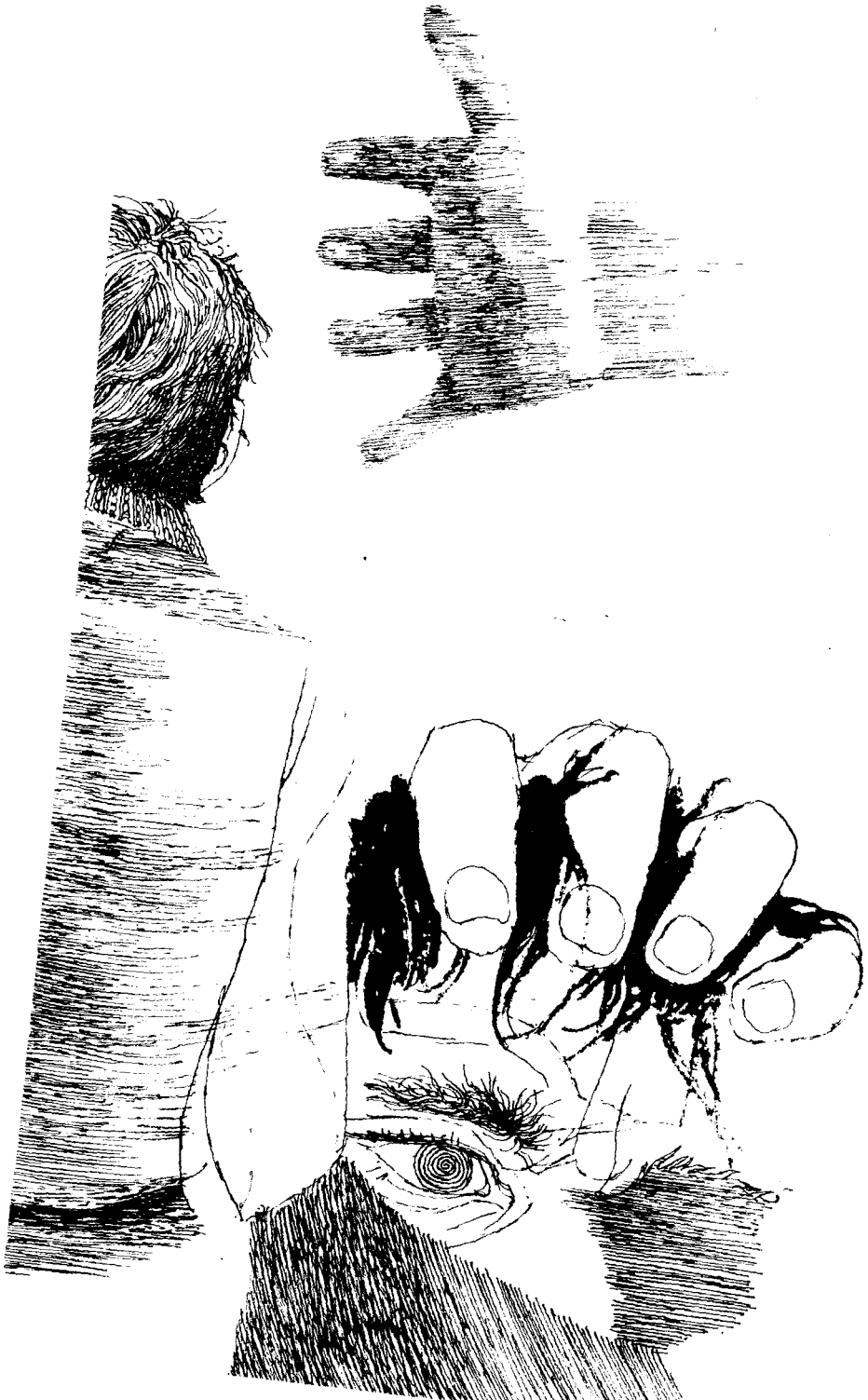

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other toys—TNT, napalm, poison gas and viruses. I leave you to their enjoyment."

He was tired. He was sick of the city and these people and all the talking. He walked off the set without a glance left or right and took Linda's waiting hand.

"Let's go home," he said.

He struggled up from nightmare to August sunshine. It was late. He turned to find Linda gone, the same unhappy discovery he had made every morning for the last eight days. She had estimated three weeks to clean up loose ends in the city—that had sounded like such a short hiatus until now.

The nightmares were bad, and they didn't seem to be getting any better. They were the final hangover of six weeks of drugged interrogation and probing by teams from every major power in the United Nations. While the UN representatives were supposed to guard him from any permanent damage, they were reluctant to exercise much restraint, lest suspicion flourish in already fertile ground.

For in the end they decided to make him a hero. President Clinton even made a pretty speech that broadly suggested Hahnemann had been acting under his personal orders. And The Man made the University happy by giving the physics department a fat grant—for research into new methods of stimulating fusion, of course, not necessarily controlled. But the big powers didn't really want to believe their nuclear investment was worthless, and they evidently weren't up on their fairy tales. They kept trying to open Hahnemann and pry out another golden egg.

Finally they seemed to have given up. Hahnemann was left battered, frayed and apparently all but broken. Had it not been for Linda, it would have been much worse, even with all his training. But somehow she supported him through the worst of it and stayed to share the best of high summer with him.

On balance, it was probably the happiest summer of his life. They climbed hills, cycled over roads and swam in his sun-warmed pond. Linda delighted in the old house and the harmony it had achieved with its woodland neighbors. Hahnemann delighted in Linda and the freshness she brought into his life. And he grew stronger.

The nightmares, however, persisted. He knew that he must do something about them, and soon. His psychopathology texts from school were in his campus office, so there was nothing for it but to go there, even though he had promised himself a summer off. He had mounted his bicycle and almost set off before he remembered that he should eat breakfast.

The physics building was a dreary place, an abandoned barge adrift on an empty green sea. Hah-

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nemann realized with a start that he used to enjoy the campus in summer because of its solitude. He had to use his key to get into his office.

Stale cigar smoke and formaldehyde still lingered in the dusty air. He had been puzzled, at first, by the meticulous care with which each lock had been violated, then restored, how each journal had been put back in its place. Such niceties stood at odds with the myriad of subtle rearrangements and less subtle smells left behind. Then it dawned on him that his office had been searched not once, but many times by many different interests. Effects accumulated. He knew *that* feeling well.

He opened the window, turned on the desk lamp, took down his well-worn copy of Rheims' "Psychopathology" and set to work. It was not easy doing the careful sequence of drills—but then it was never easy to concentrate on occasions when these drills were called for. Slowly and painfully, Hahnemann began to untwist the knots in his psyche.

The telephone jangled. He was startled out of an intricate inner search, momentarily at a loss. Annoyance was quickly replaced by a flood of anger. It was one thing to know that you're being watched, to have it flaunted was another thing entirely. With reluctance, he picked up the receiver.

"Dr. Hahnemann." The voice in his ear made no attempt to sound interrogative; it knew who he was. He recognized the mincing tenor of Blefescu, the UN watchdog. His stomach tightened—that man never brought good news.

"I regret that we must call on you once again." He probably did regret it, for all the difference that made. "This evening at six." They never gave him much warning, for fear he would have time to make some sort of preparations, he supposed. Still, were it not for the UN, people would probably be pouncing on him out of dark alleys.

"Does this really have to go on?" He made no effort to keep the plaintive whine out of his voice. "I've been turned inside out so many times, I'm not sure I can take it again." His voice had a wholly unaffected pleading quaver, even though he knew there could be no reprieve.

"You have proved to be a very tough nut to crack, Dr. Hahnemann." Blefescu had the idiom down pat. "The KGB has much respect for you Rheims people. They want to take one more look to be completely satisfied."

"Very well." Better to face the inevitable and get it over with than cringe in vain. Neither man essayed any parting pleasantries.

Tough nut, indeed! None of them had begun to suspect how tough he could be. Well, he had a few hours yet, he may as well make use of

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them. He picked up the book again, and froze.

That final wash of anger had cleared away the last inner veils. He could see clearly what the nightmare knots had so effectively obscured. He knew how to flip the world back into its old state.

Only a few hours. It would take days, weeks to be safe, to build a secure wall around that knowledge. Such a pity to hide it. The approach was altogether novel and would make for a beautiful demonstration. All he needed was—*No! Don't think about it!*

He could hide, but then they would know for sure that their golden egg existed. And knowing that was over half the job of discovering it. For one brief instant he contemplated suicide, but quickly dismissed it, with relief, on the same grounds as before. Whatever he did, it must lead to uncertainty and delay.

It was only a matter of time, Hahnemann knew, before enough nations instituted the obvious safeguard, a detector to signal entry into the old state and an automatic device to restore safety. Time. A year at least, maybe two. He had only a few hours.

For the first time in his life, he cursed the mental peristalsis that wouldn't leave well enough alone. It had to keep massaging away at the problems it encountered until it ground out solutions. Only this time it had caused an even bigger problem, one for which there was no answer.

Or was there? Slowly and chillingly, realization dawned. His subconscious had foreseen this very situation nearly a year ago, had solved it as part of the problem in general relativity. The events had been inexorable, the answer inevitable. He knew the way out, and he finally understood the roots of his fear.

Hahnemann had been sitting immobile for nearly five minutes. He stirred, lest some watcher become suspicious. Fortunately he had the book he needed in his hands and had been pausing over each of the drills before Blefescu called. He must assume that every movement was being gauged—no inconsistencies in his actions could be tolerated. With a gesture of impatience he flipped to the index and, turning to shield the book from the window, looked up "catatonia."

He skimmed the necessary paragraphs as fast as he dared. Occasionally he would flip agitatedly to some other section, but he kept returning until he had absorbed the necessary techniques.

Finally he hurled the book into a corner and stood with a jerk. He paced nervously the length of his office half a dozen times, muttering and running his hands through his hair. Then, just as abruptly, he strode out of the office, leaving the lamp burning and window and door open to the elements. Twice

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he fell before he got the bike under control.

The house looked so lovely in the afternoon light; it would be hard leaving it behind. He was glad now that Linda was not around. This was hard enough to do alone. Hahnemann let the bicycle crash among the vines and lurched into the house.

First, the journal. It took no effort to make his hand shake as he wrote:

"Can't make the nightmares go away. And now they're going to work on me again. Linda could make them leave me alone, but she's gone away. Have to hide. Until they go away and leave me alone and Linda comes back and make them go away and LEAVE ME ALONE AND GO AWAY."

That was enough of that. Better not overdo it. He turned his back on the scraggly script, taking in the familiar room and all its precious details. He never did fix that loose brick by the hearth. Too late now.

The liquor cabinet offered few choices. Someone might wonder that he should pick the thirty-year-old cognac, but that could be explained as a blind selection. He didn't care. He wanted to add that bouquet to his recent store of memories and he was willing to take his chances.

Drink in hand, he sat down by the window to savor the brandy and make a final review. The cheerful gurgle of the spring was heartrending; he forced his mind away from the outside view.

Hard nut, indeed! I'll show them a shell they won't soon penetrate. He sipped. *The Institute will get to me sooner or later. They take care of their own. They'll know what to do. A year, two at the most.* Another sip. *I'll make it.*

He savored each drop of the cognac.

It was time. He set the empty glass on the sill and turned his back on the window. There was a spot on the opposite wall, part way down. It would serve. He took a deep breath, composed himself.

Then, staring at the wall, he went quietly insane. ■

IN TIMES TO COME Jerry Pournelle's "High Justice," which leads off our March issue, deals with the fact that all social values stem not from the state, nor from social institutions, but from individual human beings. When a society is working well, these individual values may not seem terribly important. But when a society begins to disintegrate, the decisions and actions of individuals become all-important. The cover painting, by Kelly Freas, illustrates one of the key technical aspects of the story: laser-boosted spacecraft.

The factual article will be by Larry Niven, who has given considerable thought to the development of really LARGE structures, such as the sun-girdling artifact in his novel, "Ringworld." The article is called "Bigger Than Worlds."

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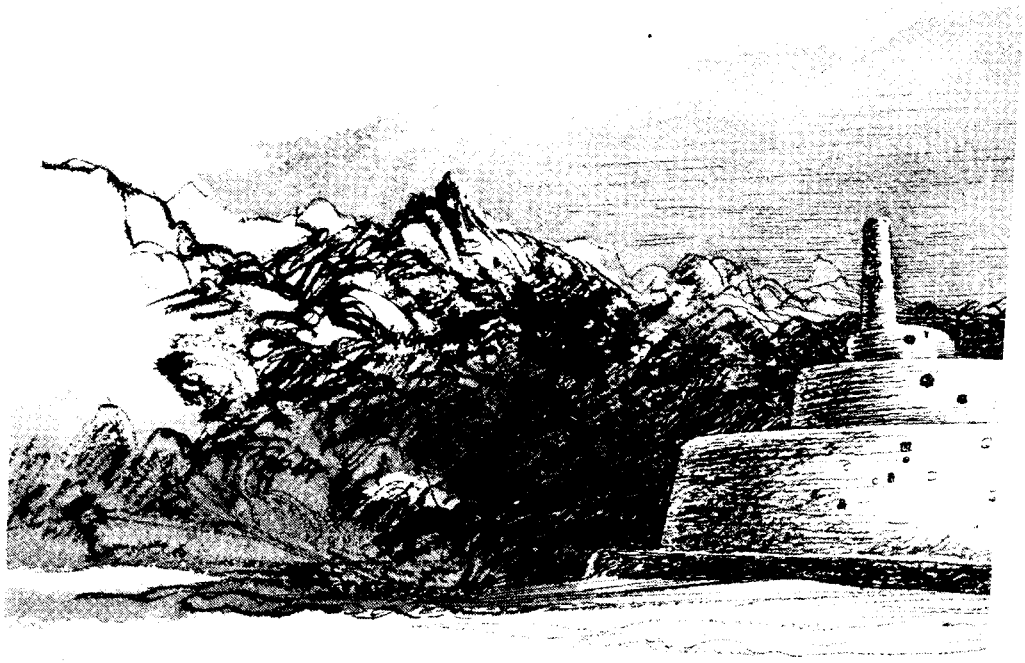

A Bonus for Dr. Hardwick

Some dreams can be turned into nightmares merely by making them come true.

BRIAN C. COAD

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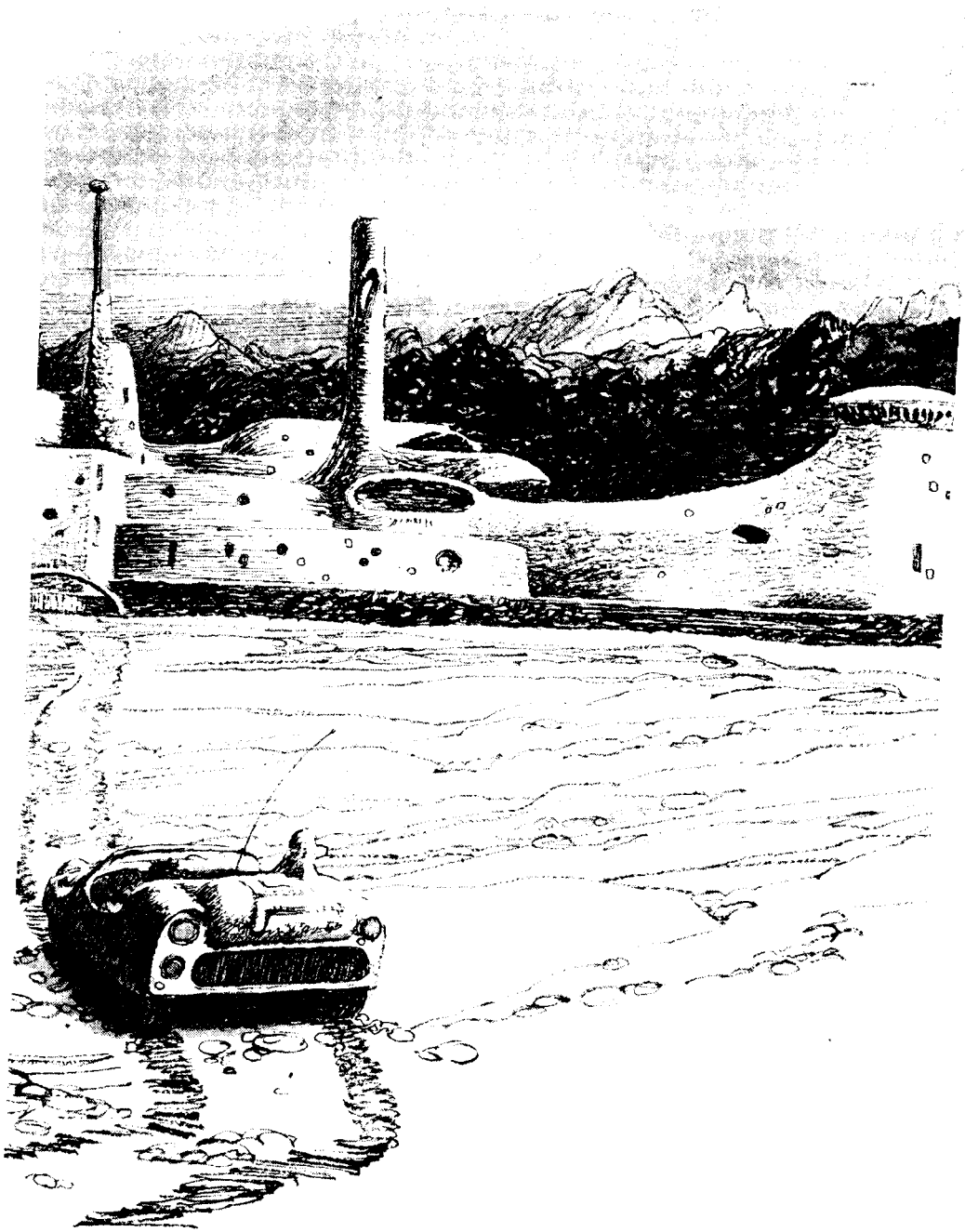

John Schoenherr

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"The Earth said, let Nevada be,
And everywhere was light."

P. Procyon Smith, a young man who described himself on job application forms as a creative scientist and amateur poet, was parked on a hillock overlooking the broad plain where the palatial laboratories of his new employers, the Long Life Corporation of America, pinnacled skyward, penning the last two lines of his poem, "Salute to Long Life in Nevada." Everywhere, indeed, was light, as the silver dawn spread across the sky from behind the snowy peaks of far-off mountains, and drove the gloom of night westward. There was no warmth in the light, and Procyon shivered in the open cockpit of his new Super-Sports Steamster—named "Loomy Al" to mark his scientist's respect for its body of luminous aluminum—which he'd bought with part of the proceeds from his father's death benefits. Only his body noted the chill in the air. His mind was busy creating a complex metaphorical relationship between the clean purity of this new day that cleansed the desert with silver luminescence, and the dawning of a new way of life for himself. Light beams glinted from the gleaming aluminum body of his car, caught his eye, and flashed a thought of his father into his head. How different his life would be from his father's! How good it was, to be of this new generation, living in this new, enlightened world! How right it was that the old world, his father's world, in this age of change should fade and die away!

Procyon had no great respect for his father, who had not amounted to anything much. He, too, had been a scientist, not a very creative one, a routine sort of a man of whom brilliance could not be expected, a stunted man, dried out and pedantic, and dead at the age of fifty-three. True, Procyon had seen work of his father's, done in his early twenties, that he recognized showed promise of creative potential, but it had never been realized. His father had blamed the company that had employed him, one of the greatest of American corporations. "They not only suck the life out of a man," he'd often said, "they squelch his will to live." That may have been true of some of the old-fashioned bureaucratic corporations. Procyon, even at twenty-four, was wise enough to be aware of his own limitations. He realized that he had not the evidence on which to base a judgment. He mourned his father's death, of course, but at the same time thought him something of a fool to let the company suck the life out of him, if that indeed had happened. Nothing like that could ever happen to Procyon. He was too quick-witted and creative, and besides, the times had changed.

The sun climbed higher, shrink-

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ing the far mountains and transmuting the silver buildings of Long Life Corporation, a towering township in the vastness of the empty desert, to pure gold. At the sight, all concern for his father left Procyon. He breathed deeply of the uncontaminated air, and thought, this is the true Golden State; he would have stayed to create another poem, had he not suddenly recalled that he had an eight o'clock appointment. He switched on the fuel to make steam, and started the drive down the steep side of the hillock. For a moment, his old self regretted the time he'd lost through missing a turnoff at Elko, a hundred miles back. Then his new self—Experimental Scientist for the Long Life Corporation of America—took over, and reminded him that there was no cause for regret in the loss of just part of one sunrise, with one poem unwritten. If he did his job as well as he expected to be able to do it, he would have all the future ages of mankind available to him to enjoy sunrises, write poems, and do whatever else he wanted.

Careful on this corner, though! It was not much use having a job that carried the life-extension bonuses if he killed himself on his way to start it. Why hadn't they built a better road? He could understand the security reasons behind Long Life's choice of a location in the remote desert. Almost everything they did at the laboratory was highly controversial, and strictly experimental, and probably dangerous. They could have afforded the money to build a better road. Procyon had only to look at the gilded buildings in front of him to be sure of that. It was probably just another security gimmick. No chance tourist was going to follow this twisted, rutted track for the hundred bone-jarring miles to the point where it ended, at the City of Long Life.

The City of Long Life. Procyon, weaving and bumping his way along as fast as he could, since it was nearly eight o'clock, ran his tongue over the phrase, and savored the taste of it. He thought of the mythical gods who once were believed to possess the elixir of life. The Ancients should be respected for their imagination. Their own poor lives, unsustained by the practical miracles of science, must have been miserable in the extreme. It was very clever of them to dream up gods and elixirs with which to comfort themselves in their misery, but just dreaming them up didn't make them exist. Whereas Long Life Corporation, though lacking the gods, which they didn't need anyway, had the elixir in reality. They called it the "Essence of Vitality," and they handed it out as bonuses instead of money, to their ablest employees. One of whom, Procyon reflected, would be himself. He'd get so many years for

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doing so well, so many extra months for this and that, until he might expect, with his ability, to achieve the ultimate: immortality.

He thought of Schlagle, the controversial scientist whose name wasn't heard much lately, because the government and people using his process didn't care for the arguments that followed publicity. Schlagle, retired now, had been a good man, and had invented the process by which vitality could be transferred from the less fit to the fittest members of the community, and it was probably the greatest single invention in the history of man. So thinking, Procyon, steering with his left hand, reached into his pocket with his right to feel the folded contract he'd signed with Long Life Corporation two days after he'd completed his PhD thesis. It was there, and he was not fantasying. He would be one of those outstanding persons chosen to be on the receiving end of the Schlagle Process. And they could not have made a better choice!

As the warming sun gave life to the air, Procyon grinned and accelerated, sweeping his car through the last mile of rough track with all the exuberance, if not all the skill, of a newly qualified racing driver. At the main gate, he drew up in a skidding turn that shot peacock's tailfeathers of sand skittering into the air. The main gate was a massive affair of fluted bronze, set in a continuous wall of black brick topped with barbed wire, that seemed to surround the city. There were two guards in black uniforms looking, he thought, like dismounted motorcyclists as they stood in their little open boxes, one on each side of the gate. If they were motorcyclists, they should have been impressed by his driving.

Procyon looked for a hint of deference in the posture of the guard on his left, who was striding toward him. All he saw was arrogance. The man had a blue, stubbly jaw, and a low forehead, and, Procyon thought, an aura of stupidity. That was not too surprising. Why should they have guards at all, a hundred miles into the desert, with only one rugged and broken track leading to it? Probably these two gorillas were not really here to keep guard. Probably they were here to be reservoirs of Vitality, from whom the Essence could be drawn to supply bonuses for superior people like Procyon. The Essence had to come from someone. It would be very logical for the Long Life Corporation to maintain an infrastructure of incompetent employees to be tapped when required. That would fit in with the government's full employment policy, as well as maintain the corporation's image of benevolence.

The guard asked to see Procyon's contract, glanced through it, and told him to turn right and report to Building Five. The second guard

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pressed a button, and the bronze gate creaked as it was drawn open like a portcullis. Procyon drove through, turned right, and found Building Five without difficulty. There were surprisingly few cars parked outside. The tall building, now that the sun was a little higher in the sky, was a warm box of bronzed glass reflecting tinted light on Procyon where he parked in its shadow. He walked across the unsurfaced parking lot, and through the enormous glass swing-doors which operated with absolute smoothness and silence. A plump receptionist with a nondescript face sat at a gleaming metal desk in the enormous entry hall. She looked sunburned because of the bronzed light filtering through the glass that constituted one wall of the hall. Over her head, printed in computer-style writing, the motto of the corporation arced in a great half-circle: THINK PROGRESS INTO PRODUCTS, AND WE'LL GIVE YOU YELLOW ROSES!

Procyon read the motto, and thought how neatly it blended the mottos of the three great corporations from the past, General Electric, IBM, and Texas Instruments, that had merged to form Long Life. The synthesis was not merely neat. It was just sufficiently incomprehensible to carry an overtone of mysticism with it. That, Procyon liked. He showed the receptionist his contract, and she told him to take a seat, while she ordered a messenger to take him to the director of the laboratory. He sat, and thought of the motto, and admired the bunch of yellow roses on her desk. She pressed one of a bank of buttons on a console by her desk, then settled to work on some papers she had spread in front of her, and ignored Procyon.

A spindly-legged girl, whom he decided to call an usherette because that description seemed to fit, came for Procyon. She was dressed in a short-skirted blue denim gown that looked like a uniform, and once the receptionist had indicated that Procyon was her client, she fixed her unblinking brown eyes on him and did not look away from him one single time as they went through a maze of corridors to the director's office. Procyon resented those eyes, which made him feel like a prisoner who had to be watched closely lest he attempt to escape. It was almost a cruelty to have that feeling thrust upon him on this of all days, the first day of a new life in which he would be free of the bondage of mortality, that hitherto inescapable penitentiary within which the vast majority of mankind, his father included, were obliged to serve their time. There were other things he did not like about this girl, whom the receptionist had addressed as Miss Frehan. She was painfully thin, her hair was ragged and wiry, with a loose forelock that she was constantly fidgeting back from her

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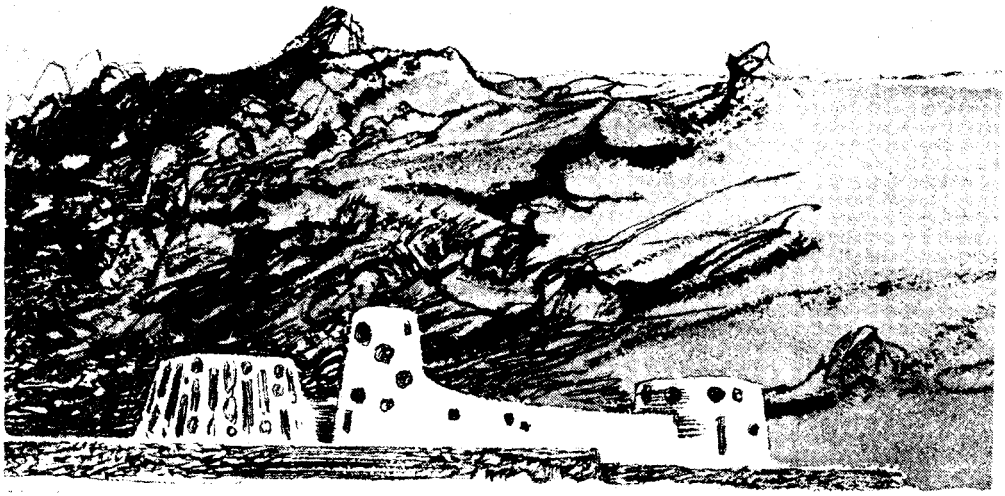

forehead with her skeletal fingers, and her mouth kept wrinkling in a small, irrational lip-twitch that made him think she was about to say something, though she never did. Procyon had made a resolution to avoid entanglements with girls, at least until he had accumulated substantial life-bonuses. He planned to devote his time single-mindedly to the service of the corporation, and intended to postpone sexual pleasures until some later time. If Miss Frehan was representative of the women at Long Life, he should have no difficulty. Although he was a little tired after his long drive through the night, he marched with springy stride alongside the mincing spindly-legged girl, and allowed himself to feel a small measure of superiority—not out of haughtiness, but to boost his morale so that he might make a better showing in his interview with the director.

The girl led him to a door over which a blue light flashed. She paused to inspect the light, advanced with a rolling motion on her thin legs, reminding Procyon of an ostrich on a morning stroll, opened the office door, and said, "Dr. Hardwick will see you now."

Despite the precautions he'd taken to boost his morale, he was nervous as he entered the office. He did not underestimate the importance of this interview. If he could make it go right, he had no doubt that he would be on his way toward a bonus of at least two or

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three centuries. He closed the door behind him, and heard a deep, gruff voice say, "Sit down, Smith."

There was a wide mahogany desk. Behind it sat Dr. Hardwick, who studied rustling papers, and in front of the desk a large red leather armchair, to which Procyon made his way. The stiff seat of the chair made an obscene noise as he sank into it. The moment he heard the noise, he froze, and sat still, rigid and uncomfortable so that it would not be repeated, and possibly misinterpreted.

Dr. Hardwick seemed in no hurry to talk to his new subordinate, and Procyon had a good opportunity to study the man. He was physically large in all directions, as befitted a man who'd probably earned a bonus of at least five hundred years, possibly even immortality. But he didn't look like a scientist. His lips were inappropriately thin for such a fat, triangular face, and the texture of his skin was abnormal, more like the texture of a synthetic fabric than that of human flesh. He wore minute *pince-nez*, too small altogether for the rest of him, balanced on a wide-nostriled nose that stood proud of his fat jowls. Altogether, he looked more like a finger-puppet caricature of a lawyer than a scientist.

Eventually the director put down his papers, removed his *pince-nez*, took a fluorescently white handkerchief from his pocket, and began to polish them. He examined Procyon coldly, his blue eyes small and piggish with no lenses there to magnify them to the proportions of the rest of his face. At length he spoke, and although Procyon detected a quality of gentleness in his voice, or thought he did, it did nothing to ease the tension he felt under the stare of those piggish eyes.

"Glad to have you with us, Smith. It's my practice, at this first interview, to do all I can to help a new employee settle down and get to work quickly. It is my responsibility to see that the corporation's money and bonuses are not wasted, and I hope you'll keep that in mind when I point out to you one or two characteristics I see that are inappropriate to the company's image. Nothing personal, you understand. I do this with all new people. It's part of my duties as Director of Research, and besides, I find it helps build that atmosphere of mutual trust without which we can hardly get our work done, can we?"

Procyon did not know if an answer was expected, and would have shuffled uneasily, had he dared, and wondered what was coming next. He decided not to speak, and the director, balancing his *pince-nez* once more on his nose, did his best to curve his finger-puppet lips into a smile. "For example, Smith, consider those glasses of yours. It looks to me as if the frames are decorated with the scales of butterflies' wings. Simple black or dark brown

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rims would be more acceptable to the company. Do you think you could get them changed?"

"Certainly, Dr. Hardwick." This was much better. Procyon removed the spectacles, which he had designed himself in a fit of technical creativity, and adjusted a minute knob on the base of one of the ear pieces. The colors subsided to a shadowed brown, not quite uniform, but a reasonable imitation of a mottled horn rim. He put the glasses on again.

Hardwick's magnified eyes grew larger. "We expect people to comply with our wishes here, Smith, but they're not usually so immediate. How did you do that?"

"A small invention of my own, sir. It's based on the kaleidoscope principle. Should I open the frames and show you in detail?" Procyon, eager to demonstrate his creative ability, quickly removed his glasses again, and held them forward over the mahogany desk.

Hardwick negatived him with a wave of his flabby hand. "No, no. Please don't think I am not interested, but I simply do not have the time. Alas, when one becomes committed to administrative duties, one must forsake the time-consuming pleasures of playing with technical toys. No, Smith, we must move on."

"Yes, sir." Procyon replaced his spectacles reluctantly.

"That tie of yours is an object rather more gaudy than the company likes."

Procyon was proud of his tie. It was not of one single color, nor of one single pattern, nor was it the same from instant to instant. Its colors were rather like those of a polished oyster shell lit by a flashing stroboscope, though deeper in tone, richer in meaning. It was an adjustable tie, again of his own invention, and he had given a great deal of creative thought to the development of a pattern he'd believed would be both suitable and impressive for this interview. Evidently he'd made an error of judgment. He reached into his inner pocket for the control box, brought it out, and manipulated the controls to tone it down to a conservative autumn plaid of green and brown. He did not think any statement was necessary.

The director clasped his hands together and leaned heavily on the mahogany desk. "Another invention of yours, Smith?"

"Yes, sir. It works on the principle of electroluminescence. Could I show you—"

Procyon leaned forward eagerly, the control box in his outstretched hand, but the director once more waved him away. "No, Smith. I really mean it when I say I do not have the time. That moustache of yours is hardly appropriate, either. I don't suppose you can alter that so quickly?"

Procyon sat back, disregarding

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the obscene creak of the chair. "Unfortunately, no, Dr. Hardwick."

"Hm-m-m." There seemed to be a synthesis of malice and triumph in Hardwick's eyes. He pushed a package of papers toward Procyon. "These are your orientation documents. They will tell you all about the corporation, what is expected of you, and so forth. Take them and read them carefully. There are some things for you to sign—insurance application forms and the like. You can return them to me by the internal mail service. Please don't be too long about it. Is that clear?"

"Yes, sir." Procyon took the bulky package and stood up.

"Good. You'll be working with Dr. Thwaites in section 21798-C, on thermoelectric materials. There's a detailed outline of the work you'll have to do included in the package. It's pretty much routine, not very exciting, I'm afraid, but if you keep in mind that it is essential, I expect you'll enjoy it. Provided you make the necessary adjustments, settle in quickly, and get down to productive work, we'll not meet again until your quarterly review in about three months."

"I'll do my best, sir."

"I'm sure you will." The director, who was picking up his rustling papers again, must have pressed a hidden signal button. The office door opened, and the spindly-legged usherette stood there. As Procyon was leaving, the director called after him: "One thing more, Smith. P.P. Smith, I see. I wouldn't let anyone know your initials. You might get a nickname that would not be at all in keeping with the company's image."

The director chuckled. Unfortunately the usherette had also heard, and was amused. Procyon was glad when one of her involuntary lip-twitches twisted the grin from her face. Outside, as they moved along the corridor, she said, not unsympathetically, "This is a great company for nicknames. One of the best."

Procyon did not feel like making conversation, and she had no more to say. They walked silently along the corridors for a very long time. As he marched along with her, his stride less springy now, he thought about his interview. It would be foolish to pretend that it had gone well. Dr. Hardwick had not been at all the sort of person he'd expected. He couldn't imagine what had motivated Hardwick to follow the interview procedure he'd used. Surely that was not the best way to put a new employee at ease and get him to put out his best work for the company. Yet in a technically oriented corporation, high-quality research work had to be the only thing that counted. Possibly Hardwick was a stupid individual, who simply did not understand that. Procyon reviewed the evidence, and decided that that was exactly what the director was. Fine.

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If a stupid man like Hardwick could work his way up to the high-bonus post of Director of Research, how much better a person with creative talents such as he possessed ought to be able to do!

The usherette stopped suddenly and turned to face him. "I've forgotten where we're supposed to be going," she said.

Procyon smiled at her. There was an attractive, childlike tone in her voice, and when her lip wasn't twitching, and she wasn't fiddling with her hair, her face was not unpleasant to look at. He said, "To see Dr. Thwaites."

"Ah, yes. To dear young Dr. Thwaites."

They continued through the corridors, which were singularly empty of people. Procyon presumed that everyone must be working so hard and with such enthusiasm that they had no time to stroll about the building. He would expect that of people who had the bonus of the Essence of Vitality to motivate them. Having overcome the disquiet his interview with Hardwick had generated, he himself was very anxious to get started.

Miss Frehan led him into a large hall partitioned by shoulder-high green screens into dozens of small working cubicles. A few people, male and female, all in white laboratory coats, moved among the cubicles. There was a great deal of noise, and altogether this hall seemed to be a very busy place. The usherette led him to a cubicle at the far end, slightly larger than most, with a cutoff swing-door beneath which he could see the brightly polished brown shoes of the occupant, and the base of the chair on which he sat. He would have walked straight in, but she caught his arm, and said, "Not without knocking."

She knocked, and a male voice, precise and serious, said, "Who is there?"

"I've brought your new man, Smith."

The brown shoes walked, and the door swung open. Procyon saw a lanky, droop-jawed young man, perhaps three years older than himself. "I'm Jim Thwaites." He reached for Procyon's hand. "Glad to have you here, Smith. All right, Schizzy, you may go."

"Thank you." For some reason the girl flashed a farewell smile at Procyon. It was the first time he'd seen her smile, and, perhaps because it was so unexpected, she suddenly seemed quite beautiful, and he responded with an intensity of feeling that caught him unaware.

Then she was gone, and he heard Thwaites saying: "Come on in, Smith. We mustn't spend all day ogling girls. Sorry there isn't a spare chair, but you can sit on the desk for the moment."

Procyon said, "That's a funny name you called her. Schizzy."

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Thwaites smiled a dry smile. "A play on words. Schizzy Frehan. She is quite mad, you know. Or didn't you notice? Old Hardwick probably gave you such a lecture that you didn't feel like noticing anything."

"He was rather difficult."

"Well, don't worry about it. It's just his way of doing things. As long as you live within your budget and get your reports out on time, he won't give you any trouble."

"The sooner I can get to work, the better I'll be pleased."

"Yes. They're all like that when they first get here. I see from your file you're supposed to be very creative, whatever that means. You'd better watch that facet of your character. Nothing loses a man bonus points like the intoxication of creativity."

What on earth did that mean? Procyon, perched on the desk with his head higher than Thwaites', who had sprawled once more in his swiveling office chair, looked down on the older man and wondered if this might be another stupid one. Surely Long Life Corporation needed, above all, creative, original work from its scientists. Budgets and reports were trivial matters compared with that. Thwaites himself did not look very creative. His cheeks were hollow, his eyes shifty and anxious. Perhaps that was the trouble. Probably he was only capable of routine, pedestrian work, and resented anyone who might be able to do better.

Thwaites stood up. "I see you have some things to read, and I have work to do. You'd better use this bull-pen until I can find another place for you. Better still, consider this one yours, and I'll find another for myself. Take your time to get yourself oriented, then we'll see what you can do."

Thwaites left, and Procyon moved to the swivel chair and settled down to read the bundle of documents the director had given him. It didn't contain very much that he didn't know already. There was a letter of welcome from the president of the corporation, a lot of information about the bonus scheme that wasn't really information at all, but merely an exhortation to work hard and trust the company, and the company would take good care of him. He read it all carefully, but couldn't get excited about it. Apart from anything else, the style of writing was too flat and uncontroversial to appeal to an amateur poet. When he came to the items that applied specifically to himself, those which defined the program of work he was expected to carry out, he was as astonished at the detail in which it was laid out for him, as he was bored with the style of the writing. If he followed this program to the letter, he wouldn't have to think at all. At the first reading he was angry. If the company felt it necessary to spell everything out so care-

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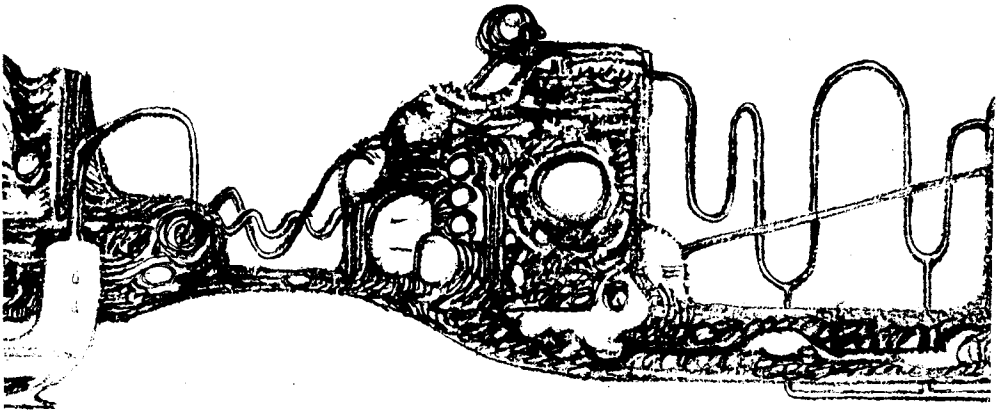
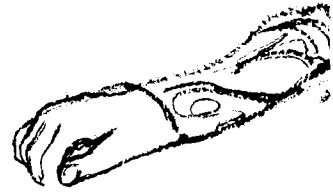


fully, they obviously had no confidence in his ability. On second reading, however, he detected certain flaws in the program, some subtle aberrations of logic, that made him wonder if the whole thing wasn't a test set up to measure his competence. He had convinced himself that that was it, and had almost decided that he'd best ignore the prescribed program, and work out one of his own, when there was a knock on the swing-door. Procyon rose, went over and opened it, and found the usherette there. She ran her rich brown eyes over his face as if she was trying to remember something, then said, "You are Smith? I have to take you to get your Vitality Index measured at the medical lab. God help you."

Thwaites was right. This girl was surely mad. Procyon said, "Yes, I'm Smith. Let's go."

Now that he knew how it was with her, Procyon felt sympathetic toward the girl, but he could not think of anything useful to say to her as they walked through the corridors. Fortunately, this time, their journey was short. She ushered him into a long, wide room, white and aseptic, with twenty or thirty surgical couches in line down the center, each surrounded by a complex glassware apparatus, and with a bank of anti-glare operating lights over it. She brought him to couch number twenty-three, on which she urged him to lie. He eased himself onto it, and smelled the fear-provoking scents of hospitals—ether



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and antiseptic and formaldehyde—but felt more excited than nervous. He examined the banks of apparatus by the couch, and tried to guess the function of each glass-tubed circuit. If he could trace them out, deduce with his quick intellect the purpose each circuit served, and then understand how they all worked together, he would be one of the few men in the world who understood the Schlagle Process for transferring the Essence of Vitality. Most of the components were quite ordinary and familiar, but he couldn't for the life of him see how they all functioned together.

A rasping voice sounded from above him. "Miss Frehan. Miss Frehan."

The girl, who had been standing by the couch, moved forward and said, in her soft, childlike voice, "Miss Frehan here."

"Speak up, Miss Frehan. I can scarcely hear you. Do you have the subject, P. P. Smith, there?"

"Yes." The girl's voice was no louder. The sound was more like an intake of breath than a word.

"Good. Will you please take care of the procedure?"

"Do I have to?" Much louder.

"Of course. Please don't play any games, Schizzy. You know the terms of your contract as well as I do."

The girl, moving stiff as a robot, reached up to a little shelf above the couch for a package from which she took a pre-sterilized needle. She connected the needle to a flexible tube that ran to one part of the apparatus bank, took Procyon's right hand, ran soft fingers over his wrist, feeling for a vein, and plunged the needle in without words of warning, antiseptic cleaning, or local anesthesia. Procyon winced. As his blood flowed red into the tube, he said, "Are you qualified to do this?"

"I am, and they make me do it because I hate it so much." She held up the blood tube to prevent stress on the needle.

It looked like a very unprofessional job to Procyon. "What are your qualifications?" he asked.

"Master's in nursing. PhD in Physiology. What do you want?"

He didn't know whether to believe her or not. She sprayed something from a canister around the needle, eased it out, and raised the flexible tube high to drain it. Procyon saw that he was not bleeding, presumably because of the sprayed substance. A host of questions he'd like to have asked the girl ran through his mind, but he didn't ask any of them. The rasping voice from above spoke again: "Thank you, Miss Frehan."

He remained silent all the way back to his bull-pen. For some reason he felt dull and drained of energy. It could hardly be the small loss of blood that had caused it. More likely he was reacting negatively to the strangeness of the girl,

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to the strangeness of all the Long Life people he'd met so far. If he was going to get down to work, he had better shake off this lethargy.

But it was still with him half an hour later as, sitting in the swivel chair, he pretended once more to run his eye over the program the corporation had prepared for him.

Thwaites walked in. "Smith," he said, "I've just received a call from the medical lab."

"You have?" Procyon wondered if he'd done anything wrong.

"Yeah." Thwaites perched on the edge of the desk. "They say you have the highest Vitality Index they have ever measured."

"They do?" A quite irrational burst of pleasure surged through Procyon's body.

"That's what they say. Doc Hardwick'll be pleased. He likes his little boys fat. They'll be able to tap more than average Essence from you after your quarterly review."

Procyon scarcely heard the words, and certainly did not take in their meaning. He grinned rather stupidly at Thwaites. Thwaites rose to leave. "Oh, Smith," he called back over his shoulder as he reached the swing-door, "the company doesn't like that silly moustache of yours. I'd have it shaved off by tomorrow morning, if I were you."

Dr. Thwaites rattled a pencil on his desk and waited impatiently for Schizzy Frehan to fetch Smith to him. He'd spotted that young man for a troublemaker the day he arrived, and now, after three months, he had ample evidence of it, more evidence than he cared to think about. Smith had not fitted into the company at all, and had made no effort to fit. Never thought of anything but his precious work. Made no friends. Didn't even attend the smoking concerts and other entertainments the benevolent company staged to keep its employees happy here in this desolate desert. Such an industrious little boy. No wonder everyone called him P. P. So devoted to his work that he wouldn't even take time off to answer a telephone. Thwaites had to send a messenger to get him when he was wanted, and he wasn't busy with the schedule of work the company required of him, either. He was off on some silly, unimportant sidetrack of his own. He wrote no reports. His budget was shot to hell. And now this!

Thwaites looked once more at the copy of the requisition in front of him for twenty grams of neodymium 141. Fifty thousand dollars added to an already overdrawn budget. And he'd initialed the thing and let it pass on to Purchasing without even noticing. Smith must have put a spell on him, hypnotized him, or something. He hadn't put a spell on Hardwick. Hardwick had noticed, all right. He'd picked it up too late to cancel the order,

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too late to do Thwaites any good, but in good time to subject Thwaites to the verbal demolition that was Hardwick's own sadistic specialty. It had been useless for his subordinate to plead that he was merely following the policy laid down by the company—to give a new employee all the freedom he needed to chase the mirages of his own pet enthusiasms until he acquired wisdom through failure and came to understand for himself that the company's ways were best, and it made good sense to follow directions and do as he was told. If the cost had been five hundred dollars, or even a thousand, Thwaites would have merited praise, not a reprimand. It would be a reasonable and acceptable part of the cost of integrating Smith into the company and converting him into a loyal and reliable employee. But fifty thousand was much too high a price to pay. It would be years before the company saw its money back. Did Thwaites believe the company was one of those wishy-washy, philanthropic, nonprofit organizations? Was that what he thought? Eh? Eh?

It would be worse for P. P. Thwaites allowed himself to take a melancholy pleasure in that. Just wait until Hardwick saw his long hair, and discovered he'd refused to shave off that defiant and overgrown moustache, and detected the supercilious contempt lodged deep in the young man's dreamy eyes! Hardwick would tear him to pieces! Luckily, today was the day when Hardwick was scheduled to give Smith his quarterly review, as well as have a friendly chat with him about the neodymium. Thwaites came close to leering as he conjured up in his imagination a picture of eager young P. P., crushed and subdued after the director would have finished with him, come dripping back through the corridors like a beaten puppy dog being housebroken.

But Thwaites was too serious a man to allow himself to linger, savoring the pleasures his imagination brought him. He glanced at his watch. Schizzy Frehan was taking an inordinately long time. If she didn't bring Smith soon, there'd be another point against himself for keeping Hardwick waiting. Should he abandon his position of supervisor's superiority and go search for Smith himself? He just might find the two of them in a remote corner of the laboratory, making out among the power-generating banks. Many times he'd noticed P. P. gazing after Schizzy with glazed eyes when she'd passed near him—about the only human attribute he'd ever detected in the young man. P. P. had a thing going for the mad girl, all right, but it was unthinkable that Schizzy would encourage him. She was too loyal an employee. She'd never abuse company time in that way. Anyway, she never encouraged any man, even outside

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working hours. Thwaites knew guys who'd tried. He'd even been tempted himself. A mad girl was better than no girl at all in this arid and emasculating wasteland, where the company prostitutes, disguised as dancing girls for the smoking concerts, only visited a few times a year, and never had time to satisfy half their clamoring customers when they came. But Schizzy and the other women employees kept themselves untouchable, even those few girls who, unlike Schizzy, did not walk about befogged in an aura of preoccupied frigidity. They had to avoid amorous entanglements. The company would give them hell come bonus time if they didn't. Again, a wise policy. If sexual distractions were set free to rampage through the place, nobody would get any work done.

Perhaps that self-centered young pup of a P. P. had gone for a walk in the desert to get inspired or take a leak or something. Thwaites wouldn't find it too surprising if he had. He spent all his Sundays out there, lugging a knapsack full of food and water on his back, walking alone. Six days he labored fifteen hours a day in the lab, and the seventh he spent communing with the barren sand dunes under the hot sun. Crazy! Had to be. No other explanation possible. Thwaites just hoped it wasn't part of his job to try to curb such eccentric behavior in his subordinate. Nobody had ever said it was, but the company, for policy reasons, didn't tell its people everything. He'd always found this madness of Smith's faintly amusing. Perhaps he shouldn't have been amused. Perhaps he should have stopped it. If so, he'd done wrong again, and that would be one more black mark against him, one more bonus point lost. But he could hardly believe that Smith would be so irresponsible as to walk out into the desert during working hours.

There was a knock, and Schizzy had the door of the cubicle open, holding it wide for Smith to enter. Thwaites swiveled his chair around, extended his long legs, sat back, tapped his fingertips together in his irritated way, and glared at the pair of them. He got a good reaction from the girl. Uncontrollable lip-twitch after lip-twitch twisted her face. He got no such reaction from Smith, who had the rudeness to grin, his eyes sparkling. "You took long enough," he growled.

The girl, flustered as a netted bird, said: "Would you like me to wait outside, Dr. Thwaites?"

"Please."

There was a cold draft of air through the cubicle as she went out and let the swing-door swish shut behind her.

"I had to wait to complete an experiment," Procyon said. "It wasn't Miss Frehan's fault we took so long."

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"She'll get her reprimand later, just the same. The company can't let people get away with inefficiency, and it was very inefficient of her not to get you here quicker when she knew I was waiting."

Procyon was anxious for the girl. "It would have been much more inefficient to lose the experiment. Half my neodymium would have gone down the drain."

"*Your* neodymium, Smith? The company's neodymium. I wanted to speak to you about that, but you have been granted one piece of luck. I hope you enjoy it. You're due in Hardwick's office right now for your quarterly review. You'd better get along there as quick as you can."

Procyon, reading despair in the defeated expression on Thwaites' face, sought to console him. "I'm sure Dr. Hardwick won't mind if I'm a few minutes late. Sorry I frightened you with the expense of the neodymium, but it's quite vital, as you'll see, if you can spare a few minutes for me to tell you what I've been doing."

"If there was anything worth knowing about, Smith, I'd have read it in your monthly reports. People never fail to turn in favorable results."

Procyon smoothed a long stray hair back from his forehead and fidgeted with his spectacles. "I really haven't had time to bother with writing reports."

"I've noticed. And I don't have time to listen to your chatter. Off you go to Hardwick's office. Now." Thwaites swiveled around to his desk, turning his back on Procyon, and picked up the first piece of paper his fingers touched, to demonstrate how busy he was. It was the requisition for the neodymium.

Procyon twiddled the control knob on his spectacles, and ran the frames through patterns of crimson and fiery scarlet. He looked at the hunched back of the insensitive Thwaites, and realized it was useless to make a second attempt to justify himself. No matter. Even if he listened, Thwaites was too stupid and incompetent to understand what he heard. He might as well go directly to Hardwick. He, certainly, would listen with sympathetic understanding. The Director of Research of Long Life Corporation had to have the sagacity needed to perceive the importance and originality of Procyon's work, even if his underlings were inept. Procyon wiggled his moustache at Thwaites' back, turned, and swung the door open.

Thwaites heard the swish of the door, and looked over his shoulder. "By the way, Smith," he said, "what do you propose to do for funeral expenses?"

"For funeral expenses?" Procyon blinked through his violently colored spectacle frames.

"Yes. When Hardwick has finished with you, that may be the

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only problem you have left. Your company insurance isn't effective until you've been here six months, you know." Thwaites chuckled and turned back to his paperwork.

Schizzy reached out shyly and touched Procyon's arm as he continued there, holding the swing-door open, speechless. He released the door and turned toward her. She said: "I'll take you along to Dr. Hardwick now."

He said: "I know the way. I don't need anyone to take me to Dr. Hardwick."

The girl let her hand drop to her side. "He likes to keep me busy. It's just one of his little eccentricities, one which has to be humored. No one is ever allowed to find his own way to the office of our dear director. I always have to guide them there and back."

Had his guide been anyone but Schizzy, Procyon would have continued his protest. He could not transfer his resentment to this unfortunate mad girl. She could not be blamed for being trapped in the illogical meshes of Hardwick's organization. He would be, too, if he wasn't so strong and capable. He recalled the program of trivial work the company had laid out for him. Any ordinary new employee, lacking faith in himself, would have just followed that, and would, by this time, be just as trapped as the poor mad girl, never recognizing that the inanity of the set program was merely a test, cleverly conceived by Dr. Hardwick, to reveal what he could expect of his new man. What if the director chose to cultivate some minor eccentricities? A man of his genius could afford them. This about the usherette might not even be an eccentricity. It could be a display of human concern. There wasn't much else the mad girl could be doing with her time. Possibly Hardwick, in his wisdom, insisted on this escort system merely to make a girl who hadn't the wit for anything else, feel useful. He wished he knew Hardwick better. A man who would do that would be a man worth knowing well. But Hardwick had too big a job to be able to spare time showing himself to junior employees. Procyon had only seen him once or twice, and then not to speak to, since his first day with the corporation.

The girl smoothed back her wild lock of wiry hair, and asked, "What is this special work you've been doing that young Dr. Thwaites didn't want to know about?"

Procyon considered what he could tell the girl. Every creative scientist doing advanced work faced this problem. It was almost impossible to tell her about his work without giving a preliminary course of lectures, and still she most likely wouldn't understand, unless she had the necessary background of basic science. He'd try to

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put it very simply. "Thermoelectric materials convert heat directly into electricity, but they aren't very efficient. The company's set program is looking for a one or two percent gain in efficiency. If I dope some special alloys with neodymium 141, I can get a thirty to forty percent gain, though obviously Thwaites doesn't know enough about the subject to realize that's possible. He'd have listened if he did."

"Very good, young Smith, but why bother?"

"Remember all that desert out there?" Procyon gestured to indicate the vast empty expanses beyond the black wall of the company. "The sun is dropping two calories per minute on every square centimeter of it, and the white sand just radiates all that energy right back into space. My new materials will be efficient enough and cheap enough to collect eighty percent of it. We'll get all the power the world needs, directly from the sun. No more burning sulfury coal to pollute the atmosphere. No more radiation hazards from nuclear reactors. Just pure, clean sunlight, transformed to pure, clean power. And the company will be able to make billions out of it, without harming anybody."

"If you can get the company to listen."

"They'll have to listen," Procyon said. He touched the bulge in the breast pocket of his white shirt, and was about to tell the girl about the projection slides he carried there, and the short talk they illustrated, that he'd committed to memory, and was ready to give any time he had an opportunity, but they'd come through the corridors to the door of Hardwick's office, and the blue light was on to indicate Hardwick was waiting, and he had no time to say any more. Schizzy opened the office door immediately, and ushered him in with a gesture.

Huge Dr. Hardwick stared at Procyon through his *pince-nez*, and waved for him to sit in the big red leather chair. Procyon lowered himself carefully, remembering the last time he'd sat there, but he was not careful enough to prevent the obscene burp of the seat's leather as it took his weight. As he had before, Hardwick rustled papers for a while, ignoring Procyon. Finally he put the papers aside and said, "P.P. Smith, eh?"

"Yes, sir."

"I remember you, Smith. Remember the first day you came to work here. You thought it would all be very easy, eh? Not much responsibility, and doubled bonuses every quarter, eh?"

"Not altogether, Dr. Hardwick."

"You might not have done so very badly, had you taken a little of my advice. I see you chose not to get your spectacle frames changed, and not to shave off your moustache. What a foolish young

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man you are, Smith." Hardwick's eyes, piggish despite the magnifying effect of the *pince-nez*, glinted. His finger-puppet face was distorted into a wry smirk. Quite possibly, he was enjoying himself.

"Furthermore," Hardwick continued, when Procyon did not speak, "you have been most unkind to your supervisor. Poor Thwaites already had a bad record. In the three years he has been with us I have already been obliged to fine him seven years of Vitality. Because he allowed you to order that extravagantly expensive neodymium isotope, I'll be compelled to have them take two more years of Essence out of him."

"I don't understand."

"There are a great many things you don't understand, Smith. To which particular one of that multitude are you attempting to call my attention?"

"You say you fined Thwaites. I know the company is supposed to give bonuses of Vitality Essence. I didn't know it was permitted to extract penalties."

"You obviously haven't read the fine print of your contract. Where do you think the bonus Vitality comes from?" Hardwick was losing patience. This was indeed an exceptionally stupid young man, despite his unusually high intelligence quotient. What a pity the Schlagle Process only worked on highly intelligent people, as far as donors went. So many of the intelligent ones were unpleasantly like this young man. The intelligence of acceptors didn't matter, which was just as well for all the stockholders, and corporate officers, and the politicians who stole Essence from the company and called it taxes—that long list of faceless but important people who demanded larger and larger annual quotas from Hardwick, and left less and less in his hands to be distributed as bonuses. More and more, he was getting to be a kind of farmer, with no other duties but to sit here and milk these young, highly intelligent, and insufferable fools. What was this juvenile idiot, who evidently couldn't read, trying to say?

Procyon was trying to say that he believed the entire system must be illegal, but he couldn't get much conviction into his voice. He remembered what Thwaites had said when he told him how high his Vitality index was. "Dr. Hardwick likes his little boys fat."

Hardwick, his smirk tending toward a leer, said: "I have to punish Thwaites for carelessness, Smith. Unfortunately, you have been much worse than careless. It was you, after all, who ordered the neodymium, completely ignoring the fact that your budget was already overspent. Not only that, it appears that for the whole of the past three months you've done not a single stroke of work. Not one report under your signature has crossed my desk in all this time."

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"I'm not very good at report writing, sir. I can quickly tell you what I've been doing—"

Hardwick blocked off his words with the fat palm of his hand. "Enough, Smith. I know what you *should* have been doing. It's all listed here in my copy of your orientation papers. Have you done it?"

"No, sir, but—"

"You haven't? That is of minor importance. It's happened before. Some of you new employees take an inordinately long time to settle down, particularly in this modern age. Eventually you seem to do reasonably good work for the company. The important thing is that you've been so extravagant. Besides this neodymium, may I ask what you've been doing with the generous allowance of money budgeted to you, since you weren't getting on with the work assigned to you?"

Procyon felt flattened. He thought of what another company had done to his father, and toned the frames of his glasses to a dull gray, the only means available to him to express what he felt. He tried to get a note of enthusiasm into his voice, but it came out shrill and almost whining: "I've been doing the most important work done in the company for years and years. If I could use your slide projector, I have a few slides that summarize my results—"

"I'm sorry, Smith. Sit down again, if you please. You may not use my projector. Had you done anything of importance, I would surely have heard of it. The company's reporting system is very efficient."

Procyon sat down heavily, and wriggled when he was down, deliberately prolonging the flatulent belch of the seat.

"There are certain things you young people just don't seem to consider," Hardwick went on. "I am by nature a merciful man, ready to give full weight to your inexperience. At the same time it is my duty, both to you and the company, to try to guide you into a more productive way of life. Before I discipline you, I want to have a brief fatherly talk with you. When you read the program of work assigned to you, were you aware of its significance?"

"No, sir." Procyon would have liked to add, "I always miss the significance of pure nonsense," but he was too flattened and overwhelmed to say it.

"I thought you were not very clear about it. Probably I am in part to blame. I should have explained your work to you. Alas, one makes judgments, and sometimes they are wrong. I felt sure a man of your obvious intellectual capacity—but there, a research director's life is almost bound to be cluttered with disappointments. It was no accident that you were given those particular assignments,

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Smith. Had you thought of that?"

"No, sir."

"I expected not. I could hardly hope that you would understand that modern technical development consists of the integration of a large number of detailed pieces. The days of the inventive giant are gone, unfortunately. Now it is all bits and pieces, and hard, routine work. It was your job to provide me with one of the pieces. I have to fit all of them together like a jig-saw puzzle, except that it's vastly more complicated, and make a complete picture. Have I put it simply enough for you to follow?"

"Yes, sir."

"Through your negligence, one piece of the picture is missing. Hence the work of the whole department for the last three months is incomplete, and we're all of us going to fall behind, losing bonuses, and leaving the company poorer. Well, have you anything to say for yourself?"

Procyon could easily have shrieked. He could not speak.

"All right, if you've nothing to say, I'll bring this interview to a quick termination. I shall expect an infinitely better performance from you in the next three months. For now, and for your own good, I'm going to impose a fine of three years' Vitality on you. Please take this chit along to the medical lab straightaway. Miss Frehan will escort you. You're lucky that your Vitality Index is exceptionally high. You'll hardly miss a little matter of three years."

Procyon grabbed the yellow chit and scurried out, not trusting himself to speak. The spindly-legged usherette was waiting for him. "Medical lab?" she queried, in a soft voice.

"Apparently."

"I'm so sorry." Her voice was gentle as the rustle of butterflies' wings, but Procyon refused to let it comfort him. *This girl is mad,* he reminded himself. *I can't accept sympathy from a mad girl.*

As they made their way through the corridors, he thought, if he had his car available, he would simply walk out and drive away and never come back. Unfortunately, his car wasn't available. The day after he'd arrived, he'd taken it to the company garage for routine servicing, and they'd found one thing after another wrong with it, and piled delay on delay, until he'd given up asking when it would be ready. Here in the desert there was no place to drive, and the City of Long Life was completely self-sufficient, and he'd been so busy with his six long days of work each week, and quite content with his solitary walks through the desert on Sundays, that he had almost forgotten he owned a car.

The girl, who, in her present serious mood had given up lip-twitching and hair-patting, and was a quiet, unobtrusive presence be-

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side him, appeared to read his thoughts. "You can't run away, P. P.," she said. "Everyone thinks of that, but it's impossible. They'll have the helicopter police after you as soon as you drive out the gate, even if you're clever enough to trick the guards into opening it for you. Then they'll arrest you, and double the fine. You can't beat the law."

"The law is on their side?"

"Of course. How else would the politicians be sure of getting their taxes, their own important share of immortality?"

"Then what can I do?"

"Stay with it and suffer, like me. That's all you can do."

So this, Procyon thought bitterly, *is the brave new world I believed was such an improvement on my father's unhappy experience.* Then they were at the medical lab, Schizzy was leading him to a couch, having him lie on it, leaving him alone with his thoughts.

After a few minutes Schizzy returned, her blue denim minidress covered by a ghostly white operating gown. A fat little man accompanied her, tripping over his long olive green surgical robes as he forced his short legs to keep up with her for the length of the long lab. The man introduced himself. "I'm Dr. Jennings. Just lie back and relax, Smith. I'm rolling up your shirt sleeve, then you'll feel a little prick in your arm when I give you a sedative, and we'll get on with it. It'll all be over very soon."

The sedative quickly took effect. Drowsy, Procyon saw the usherette lean over him and snap a circlet on his upper arm to slow the blood flow. When her face was tranquil, and not twitching, she was really very pretty, with her high cheekbones. Distantly he felt two needles attached to the circlet puncture his arm, but felt no pain from the penetration. The fat little doctor had shuffled over to the bank of apparatus on his left. He pressed a button, a switch clicked, and Procyon heard motors and pumps cut in, then sensed his blood swishing in tubes attached to the circlet, as it was pumped out of him. The sedative had calmed him, as it was supposed to do. He no longer felt bitter or angry, and with those feelings gone, his normal curiosity returned. Although it was difficult to summon enough energy to move, he stretched his neck around to see what was happening in the apparatus. He saw the clean glass tubes shuddering from the vibration of the motors, and saw them glow ruby red as his blood flowed through them. Low down among the glassware a clean empty phial began to fill with a rich golden fluid. He wanted to see what else was happening in the rest of the apparatus. The phial hypnotized him. He could not move his head. He could not move his eyes. Before the phial was half full, Procyon had sunk into a deep sleep.

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Two hours later he came half awake. He shook his head to clear it, and come full awake, but the half-awake feeling persisted. His drugged eyes dimly saw the usherette, back in her blue dress, sitting on a white stool by his couch. Her legs seemed remarkably long and well-shaped. All shapes seemed unusually sharp to him. After a minute or two he realized that that was because their colors had become so dull. The girl's dress was blue more from what he remembered than from what he saw. What he saw was closer to a dark shade of gray. Her normally red lips were a different gray shade, and her cheeks a different shade still. He blinked his eyes rapidly, and expected his color vision to come back, but nothing happened. He lacked the energy to move any muscle but those of his eyelids. More than that, he did not want to move. Nothing in his mind had importance, or even priority, any more. If nothing was important, he might as well just go on lying there, motionless, blank-minded, forever. He let his eyes droop closed again.

It may have been immediately afterwards, because she had seen him blinking, or it may have been a long time later, because it was time for him to wake up, but when he opened his eyes again, the girl was leaning over him. She was still a gray-faced lady. She said: "Hello, P. P. Do you feel well enough for me to guide you back to your apartment?"

He sat up very slowly, the movement forcing a grunt out of him, and eased his legs over the side of the couch. His knees buckled, and his feet fell to the floor in uncontrolled freefall. There was a slight tingle in his arm where the needles had been, but he felt no pain, and but for the weakness and utter lethargy that hung over him like a suffocating blanket, there seemed to be nothing wrong with him. He glanced at the apparatus bank and saw that the equipment had been cleansed of blood and was sparkling like diamonds, ready for the next victim. The phial of golden fluid was gone. He forced himself erect, staggered, and would have fallen, had the girl not supported him. Once he was balanced, he was all right. His muscles had not really been weakened. Yet when he swayed slightly, he almost toppled again. The problem was not in his muscles, which saved him easily enough, when he was able to order them to act. The problem was in his reaction time. The necessary messages, which normally flashed along his nerves, now merely trickled through. His thinking, too, was slow, slow, slow. He wanted to say something to the girl, but the thought of what it was formulated so slowly in his mind that it looked as though it would be several minutes before he'd be ready to speak it.

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The girl said, "We'll take it very slowly, P. P. Lean on me."

He leaned on the girl, wondering why he thought that was strange, and slowly realizing that it was strange because her spindly legs and skeleton body looked too weak to support her, let alone a man of his weight. His coordination was erratic, and at times nonexistent, and it was a miracle that she was able to maneuver him through the corridors with no worse than occasional stumbles, and not one single fall. Outside, the dry heat of the desert air burned his nostrils, and his control of his body grew worse. He could not possibly have walked the quarter mile to his apartment. Fortunately, the wise company had foreseen that, and had provided a chauffeured car to bear him home. In the car, the girl rolled down his shirt sleeve and buttoned it, and saved him from falling sideways at turns. She helped him from the car and up the stairs of the terraced apartment building. His mind slowly associated the keyhole in the door with the key in his pocket, and at the third attempt his hand found his pocket and extracted the key, but it was simply too difficult and too unimportant for him to put the key into the keyhole. The girl opened the door for him and led him to his bedroom. Outside, in the bright sunlight, he had not especially noticed the absence of color because of the contrasts set up by the strong light. In his own rooms he was very aware that the richly colored designs he'd painted on the walls and cupboards had been reduced to monotone. The coverlet on his bed, a piece of Indian weaving in green, orange and black, was not a familiar thing to him now it was toned down to gray. Only the black areas were unchanged. The girl helped him sit on the edge of the bed, and he would have liked to flop back and just lie there, but she had said something or other, and he could hear her in the bathroom now, and the sound of water running, and he vaguely understood that the time to sink back and sleep was not yet.

Schizzy—that was the girl's name, he remembered, after a great effort—quickly had a hot bath ready for him, and then she was undressing him, and his lethargy was so great that he felt not a trace of embarrassment. When she had him in the bath, and he felt the warm comfort of the water seeping through him, she slipped off her blue denim dress, and came in her underslip to sponge his back. She explained that she was, after all, a nurse, so that seemed to be all right.

The bath did him good, and he was able to stand still almost without a wobble while Schizzy toweled him down. She led him to the bed, pulled back the coverlet, which seemed to have become a little brighter, though not much, had

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him lie down, then threw off her own clothes and snuggled in beside him. His mind was working too slowly for him to think about why she should do that, but he did experience a small sensation of pleasure when she leaned over him, supported on her arms, and said, "You were such a beautiful young man before this, Procyon."

Then she made love to him, and the muscles she stimulated seemed to work by reflex action, needing no conscious direction from his head, so that mechanically it went quite well, and he was troubled only by the delay in his nerves which put the pleasures he felt out of step with the physical stimuli on which they were based. This had a disorienting effect on him, and made him feel quite dizzy, but the pleasures were real, nonetheless.

When it was over, she kissed him long and slow, then raised herself up on her arms again to look at him. Her face, free of all sign of lip-twitching, was unbelievably beautiful, but for one thing. She said: "They sometimes tell people the Schlagle Process makes young men impotent. You won't believe them if they tell you that, will you, Procyon?"

He shook his head, and with the movement saw that what was wrong with her face was something on the upper lip, and reached up to touch the lip to find what was wrong. When he finally got his hand to the right place, he discovered that the shadow he saw there consisted of hair. Schizzy saw the hairs on his fingers, and ran her fingertips over his moustache. "It's falling out," she said. "I'm sorry, Procyon. Sometimes that happens. So the company wins that battle, too."

Possibly Procyon's mind was beginning to act faster. For some reason the knowledge that he was losing his moustache seemed more important than anything else. "But it will grow back again, won't it?"

Schizzy shook her head, but at the same time said, "Possibly."

Procyon closed his eyes, and thought of what the company had done to him, and felt mildly angry. The girl nestled her head on his shoulder, and that comforted him slightly. After a time, he opened his eyes again, and said, as gently as he could, "What are you all about, Schizzy?"

She levered herself up to look at him again. "I'm mad, so I don't suppose I'm about anything."

"Why are you here? Why do you have such an odd job for the company?"

"I didn't always have it. I used to be a research scientist, like you. They fined me so much, Procyon, my dear, I so hated the immorality of the whole bonus system, that I let myself go mad, and made them give me a job outside the system."

"Why didn't you leave?"

"Leave? Haven't you read your contract? It's impossible to leave."

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She thought for a moment, then added, "Except the way I have."

Procyon took two days off from work, and returned on the third day feeling not much less lethargic and drained than he had immediately after he'd been processed. His mind was acting a little faster, though nowhere near normal. He found he still had to move carefully if he was not to become uncoordinated and lose his balance, and although he could distinguish colors by now, they were dull and lackluster, as if all the life had gone out of the world. He had tried to write a poem about the world as he now experienced it, but there were no verbal rhythms in his mind, and it was quite impossible for him to put words in patterns that contained even the simplest of rhymes.

The girl had been to see him twice while he was convalescent, though not to make love. The twitch had returned to her lip, she was having her former difficulties with her rebellious hair, and she visited him merely to check that he had food and any other supplies he needed. He could not decide what he should do about the girl. He could not think well enough yet to make decisions. Nor could he act on a basis of feelings alone. His emotions were warped and dull and colorless, hard to interpret, and giving him no guidance.

Back at work, he was content to do nothing most of the time. The company, as usual sensitive to the welfare of its employees, had officially relieved him of the need to submit reports and budget summaries for two weeks, so that, unless he got on with his own work on solar power, there was very little for him to do. He had lost all interest in solar power. Besides, someone had robbed him of his neodymium while he'd been away, or perhaps they had inadvertently flushed it down the sink. At any rate, it was gone, and he could hardly order more, even though he had to drop that line of work without it. He tried to get his moustache growing again, but the hair on his face grew thin and straggly now, and he realized after a few days that he might as well admit defeat and go clean-shaven. Fortunately he did not lose the hair on his head. But he did get a haircut.

By the beginning of the third week, though he felt not much better, he was able to sustain a line of thought for long enough to decide that he must, at all costs, get back the quota of Essence of Vitality of which he had been robbed. It seemed to him that he could only do that if he complied with all the company's instructions and directives, and earned bonuses, so at the end of the week, in spite of his enervation and lack of material, he prepared and submitted the required weekly reports.

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Day followed monotonous day. The work the company wanted from him lacked excitement, and quickly became a routine. He worked short hours, and spent his spare time exercising to improve his coordination. The improvement was very slow. It was only on the fifth Sunday that he dared go out for his customary walk in the desert, and then he did not venture far. Because he had been so indecisive, or so he thought, his relationship with the girl, Schizzy, did not develop. He saw her occasionally in the corridors, and often sensed her presence without seeing her, as if she was watching him, but she gave him no special sign that she was interested, and he simply had not the energy to approach her. His initiative was shot to hell.

One day he happened to encounter Dr. Hardwick in the men's room. "Ah, Smith," the director beamed, as he struggled with the zipper stretched taut across his abdomen, "I see you've mended your ways. Your reports come through regularly now, and every week I enjoy reading them."

Procyon grunted his thanks, and the director went out. Procyon rinsed his hands. As he was drying them, he caught a glimpse of a face in the mirror. He looked at the face for several seconds before he realized it was his own. Good God, he'd thought it was Thwaites!

The shock of that confrontation with himself started a small fire in Procyon, who was by then beginning to see the colors of the world a little more clearly. Suppose he had deserved the fine the company had imposed on him, had they any right to take those three years from the vigorous, creative days of his youth? Had they the right to do what they'd done to Schizzy? Surely, if they were entitled to anything at all, they were entitled only to the dregs of young people's Vitality, not to its prime Essence. They had destroyed Schizzy, and come close to destroying him. However good the bonuses returned to either of them later turned out to be, they could never compensate for what had been taken. He would not let them get away with it. He would fight them. He and Schizzy together would fight them.

The girl, when he found her, was not very receptive. "You're wasting your time, P. P.," she said. "There's nothing we can do."

"We can escape."

"How? In your car? Even if they let us out, we couldn't get ten miles before helicopter police found us."

"On foot. We can walk across the desert to the mountains. They'd never spot us on foot, walking through the desert."

"Do you really think my spindly legs would carry me across fifty miles of sand? There's another group of observers who would spot me long before I got to the mountains. The vultures."

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Procyon looked at the emaciated girl, and could not argue.

"Say we did escape," she went on, "what do you propose we should do? Live on in hiding, in our present condition, depleted of Vitality, until we starve to death, or the police catch up with us and bring us back?"

"Once we're safely away, I have money. I have money from my father's insurance, and I've not spent anything while I've been here. Between us we can work out how the Schlagle Process works. I had a good look at the equipment. I have a pretty good idea of it now. Other people will sell us their Vitality for money. We can buy our Vitality back."

She worked hard on the raggedy forelock. "You always steal Vitality, P. P. You can never buy it. And I can never go with you across the desert."

Her eyes clouded over and for a moment she seemed disoriented. She said, in a faltering voice: "There is something about the work I was doing before . . . if only I could remember . . ."

Procyon caught her arm. "Try, Schizzy. Try!"

Intense pain flickered across her face and her lips twitched frantically. "It was about the Essence of Vitality—the work I was doing—my own personal project . . . when I was a research scientist like you . . ."

Procyon gripped her arm harder, and looked away because he could not bear to look at her poor distorted face. He felt her grow suddenly tense, and he was compelled to turn toward her again. Her lips no longer twitched, her face was tranquil, and her eyes shone. "It was a synthesis procedure, P. P.! A method to synthesize the Essence of Vitality. A few more months of work, and I would have got it. But they drained me." Her face went blank again, and she shuddered. "They drained me with their fines. I hadn't the energy to go on with the work, and I made myself forget all about it so they would never find out."

Excitement grew in Procyon as the implications of her words came home to him. If she could tell him the lines to work on, and he could get away, and complete her work, there would be no need for this laboratory in the desert, no reason for them to keep Schizzy. Anxiously he demanded, "Did you tell Hardwick about this?"

"Oh, I tried to. You can bet I tried to. But I'm afraid our dear director was much too busy to listen to the ramblings of a poor mad girl."

Procyon remembered his own attempt to communicate with Hardwick, and believed her. She went on, her voice flat and colorless now, as if she had lost the direction of her thinking: "But of course I wasn't mad then."

He spoke sharply, hating to do it,

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but feeling it was essential to force her back to reality. "Could I complete your work?"

She inspected him closely, and a smile lit up her face. "Procyon, my dear, I'm sure you could do anything."

"Do you have notes? Formulae?"

She shook her head. "I destroyed them all. But if I think very hard, I am sure I can remember—"

"Then all we have to do is get away."

She looked down sadly. "However much I manage to remember, I still won't be able to walk all that way through the desert. But I could write everything down. You could take it with you, get the work completed . . ."

"Schizzy, my dear, if it costs me all the strength I have, I swear I'll come back for you!"

The vehemence of his words shook her into a completely rational state of mind. "You'll have to have a sample of the Essence to help you develop the synthesis."

"Is there any way I can get a sample?"

She stood very tall, completely calm now. "Yes. We can rob the storage vault. I know where one of the keys is kept, and I know how to get there. That knowledge is part of my job."

They decided that a Saturday night would be the best time for the robbery. Then on Sunday Procyon could merely walk through the gates as usual, his knapsack on his back, for his walk in the desert. With luck, no one would notice his absence until next day. By then he should be close to the mountains, and it would be impossible for them to find him and catch him.

The week ticked on slowly. Procyon, so that he would not be too conspicuous on the Saturday evening, stayed late in his office every night, as he used to do before he'd been processed. After the first night, the prowling guards on night duty took no notice of him. To fill the time, he did a more thorough job than usual on his weekly reports, and had them submitted a few hours before they were due. He saw very little of Schizzy during the week—they felt that any unusual behavior just might be noticed and reported—but he could tell from her suppressed smile and the light in her eyes when they met by chance in the corridors that she was working on her part of their plan. With everything going well, and a definite end to his captivity in sight, Procyon felt something like his old self again. For the first time since his ordeal, he amused himself by adjusting his spectacle frames and his tie to illustrate the moods that flowed through him hour by hour. But the time passed desperately slowly.

On the Saturday, Procyon worked late as usual, and as usual was not noticed. Schizzy, with no such habit to justify her presence,

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squatted concealed behind Procyon's desk. Without anyone seeing, she had already managed to slip him her notes on the Vitality synthesis, as far as she'd taken it, on the previous day. He'd read it, and had it hidden safely in his knapsack. There were a few minor questions he'd have liked to ask, but they were of small account, and they didn't dare talk while the guards prowled. At midnight the guards would go off for their meal, and they could act. Meanwhile, Procyon worked on a stack of papers piled on his desk, and Schizzy sat still.

Midnight came, and when Schizzy had massaged the stiffness out of her cramped legs, they hurried along the silent corridors, their faces ghastly in the pale blue pilot lights. Schizzy led him directly to Dr. Hardwick's office. The office door was not locked, but the drawer where she said the key was kept appeared at first to be. They couldn't tug it open, and Procyon was almost ready to smash it. Schizzy stayed him, and prodded the gap between the top of the drawer and the desk with a nail file. Something solid had wedged in the gap, and made the drawer stick, but she was able to wiggle the wedge loose with the nail file, and they were able to pull it open. It was very heavy, crammed to the top with samples of metal strip and other oddments, but the key was easy to find, right at the front of the drawer, and not buried very deep in the samples.

They practically ran to the medical lab, where the vault was tucked away under the processing room, down a spiral staircase. They had to hurry, because Procyon knew that, although the guards had very little to do, they never dawdled over their meals. The steel door of the vault, which was very like the huge walk-in safes Procyon had seen in banks, opened easily. There were no alarms.

There was a single amber light inside the vault. At first, although their eyes had become accustomed to semidarkness in the corridors, it was too dim for them to see. As their vision grew more sensitive, they saw row on row of U-tube phials laid out on half a hundred shelves, each leg of each tube decorated with a small amber star, the reflection of the single light. The vault was not refrigerated, though it was cool. Schizzy had said the Essence would not deteriorate if it got warm, but Procyon was relieved to find it was not stored frozen just the same. All the phials appeared to be full, and he moved forward to grab the nearest. Schizzy tugged his arm and said: "No. There is a special one."

She led him deep into the vault, and stopped before a particular shelf with a label attached to it. He screwed up his eyes and came close to read the label. It said: *Reserved for Dr. Hardwick.*

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On Dr. Hardwick's shelf there were three U-tubes of Essence, all of them larger than most in the vault. Procyon took one of the tubes in his hands, and saw that it, too, was labeled. The label said: *Six years.*

Schizzy was gone to the back of the vault. She returned with a styrofoam container, from which she took an empty tube. She had Procyon hold it, and replaced it in the container with the full tube he had in his hands. She gave him the closed container, and was putting the empty tube on the shelf when she had a thought.

"Do you want to fill this, Procyon?" she asked.

She took the stopper from one leg of the empty tube, and passed the tube to Procyon. He saw at once what was needed. She said, "As long as the tube is filled with golden fluid, they'll not even suspect they've been robbed."

He was not quite able to fill the tube, but it was probably good enough. The six-year label was already on it. The tube looked completely normal back on the shelf. There was no reason why anyone should suspect anything, even when they were injecting his annual bonus of eighteen extra and unearned years into the fat director.

In haste, they locked the vault, and ran through the corridors to return the key. There were no guards in sight when they entered Hardwick's office. When they cautiously opened the door to leave, they saw one returning from his meal, far-off, a puppet man in the long perspective of the corridor. Procyon pulled Schizzy back into the office, and closed the door. Fortunately they'd already turned off the office light before opening it. There was no place to hide except under the massive mahogany desk where the director kept his fat feet. The two of them squeezed in there, and it was very pleasant for Procyon, despite the approaching danger of exposure, to feel Schizzy so close to him.

They heard the door of the office open. They heard no feet scuffing toward them on the carpet. The door closed. They waited. After five minutes or so, Procyon peeped over the edge of the desk. There was no guard to be seen. They again opened the door of the office, this time still more cautiously, but there were no guards in the corridor. Procyon knew their prowl times, and it was not difficult from there on. No one saw them leave the building. Outside, the night air of the desert was very cold. At midnight, the street lights of the City of Long Life were turned off to save money for the company, but it was not too dark. In the cloudless sky a myriad of twinkling stars brightened themselves to light their way. Procyon reached for Schizzy to draw her close so that she would not get too cold, and

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wondered what words he should use to ask her to stay the night with him. She shook him off, and said, her voice very tense, "Goodbye, Procyon. I've done all I can. I must hurry home now. Don't forget to come back for me. Please?" Then she was running from him, the calves of her spindly legs twinkling in the starlight.

Procyon stood still and watched her until she faded into the darkness, and only when he could no longer see her did he truly realize that he would be leaving her behind, alone. He cursed himself for an idiot. All week long he had taken it for granted that Schizzy would not be coming with him. That was part of their plan, and

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he'd just accepted it, never considering for a minute what it truly meant for Schizzy, what it meant for him. He moved to go after her, angry that he had not spent every second of the last week working out some plan by which she could have come with him. But if he chased after her, what could they do? The carton containing the Essence was heavy and conspicuous under his arm. It was certain that Schizzy had not the physical strength to go with him, even if he could think of some way to smuggle her out with him in the morning. If he went after her now, and was seen, and was questioned about the carton, that would be the end. He would never be in a posi-

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tion to help her then. Reluctantly he turned his back on the place where she had vanished, and headed slowly toward his own apartment. As he went he vowed that he would use every hour of every day and night, and every ounce of creative power that existed in him to finish Schizzy's work, and when it was done, would set off without rest to come back and set her free.

Morning came, and he woke refreshed, and considerably surprised that he'd been able to fall asleep. He cooked himself a light breakfast, ate quickly, searching his mind the whole time for a glimmer of an idea for a new plan that would allow him to take Schizzy with him, but could not find one. He checked his knapsack to be sure he'd not overlooked anything, and glanced for the last time around his apartment. He was leaving most of his personal belongings behind, and preoccupied though he was with thoughts of the girl, he noticed that he did not regret leaving them. Material things were always a burden to a creative man. He hoisted his knapsack, and left.

The guards, used to his Sunday excursions, gave him no problems at the gate. In half an hour he'd put two miles of sand and scrub growth between himself and the city. At the top of a small hillock, the mountainwards companion of that on which he'd stopped his car for his first view of the City of Long Life, he paused and looked back. He saw, as he had on that first morning, the fine buildings of the city transmuted to gold by the sun. He saw, something he had overlooked then, the sinister line of the black wall encircling the city, and for an instant he thought he saw the puckered face of the usherette, also gilded, superimposed on the golden buildings, and it seemed to him that the imprisoning wall was a wall around her, her only. With his right hand he reached behind him and tapped his knapsack, where he had his sample of Essence, and the girl's notes, and he vowed, "By God Schizzy, I'm going to make your process work, and I'm coming back for you."

Almost a treachery, the thought slipped into his mind unbidden, *Even if her process won't work, I'm getting away with six years' Essence in my knapsack, and I'll at least get my own three years back.* Then he thought of Hardwick's stored bonus of eighteen years, and for that, and for the other, treacherous, thought, he was suddenly very angry, and he yelled aloud to the dry, unheeding air and the unconcerned blueness of the sky: "Piss on Dr. Hardwick!"

After that, he adjusted the straps of his knapsack to be more comfortable, turned his back on the city, and strode off eastward across the desert toward the distant mountains. ■

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P. Schuyler Miller

FROM ANOTHER SHORE

Very slowly, American readers are beginning to realize that science fiction is not solely an Anglo-American province. Oh, we've always recognized Jules Verne, and in the last few years we have had a few collections of Soviet and eastern European science fiction, but we have seen very little from the rest of the fiction-reading world. Now a new publisher, Seabury Press, has launched a series of what it calls "science metafiction" with five books by leading European science-fiction authors, including an anthology edited by Franz Rottensteiner, "View from Another Shore" (Seabury Press; 234 pp.; $6.95).

Rottensteiner is an Austrian whose magazine about science fiction and fantasy, *Quarber Merkur,* was one of the first serious journals of its kind. He edits a new science-fiction series for the German publisher, Insel Verlag, and I believe he has served as an agent for a number of American and English SF writers. His reports on the state and status of European SF appear regularly in the fanzine, *Luna.*

As Rottensteiner points out in his introduction to "View from Another Shore," Americans in particular are cut off from European science fiction by what might be called economic insularity. Whereas most Europeans can read English well enough to read and enjoy English and American SF, American editors in particular are usually limited to their own language. They can't read foreign-language stories, and to make any substantial use of such stories they have first to find and get the original publication, then have its contents translated—let me add, well translated, because a poor translation can turn a good story into a mediocre one—and only then decide whether it is something they want to publish. Happily, there are now multilingual Europeans, well versed in current science fiction and fantasy, who can be trusted to do the initial screening. Franz Rottensteiner is one, and I suspect the Swedish historian of SF, Sam Lundall, is another. I hope they turn us up a rich harvest.

"View from Another Shore" gives us eleven stories—three from Russia, two from France, and one each from Poland, Denmark, West Germany, Czechoslovakia, Rumania, and Italy. A few are fantasies rather than science fiction. And, I think, poor translations may have taken the sting out of some of them. Those by one Matthew J. O'Connell (of whom I know nothing at all) read best. Perhaps they

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do in the original language, too.

My own top choices are "The Altar of the Random Gods" by the Rumanian, Adrian Rogoz, "Sisyphus, the Son of Aeolus" by a Russian, Vsevolod Ivanov (recently deceased), and "Good Night, Sophie," the Italian contribution by Lino Aldani. I hope I am not being provincial in preferring them only because they read most like our own brand of science fantasy.

"The Altar of the Random Gods" is a beautifully detailed projection into an American future where the freeways have been developed to their ultimate and a blundering driver achieves universal immortality, in the eyes of galactic observers, by setting off a practically impossible accident. "Sisyphus" is a gentler but none the less critical excursion into Greek mythology, in which a veteran of Alexander's campaigns, making his way home to Corinth, encounters the legendary son of Aeolus rolling his great rock up a mountain. Ivanov, who died in 1963, is considered one of Russia's great modern writers, and it is easy to see why. I'd love to see what he might have done with other myths, subtly uncovering the human truths buried in them and suggesting others. We have all known Polyander, the old soldier, and the patient Sisyphus who cannot accept release.

Aldani's story is in its way a gadget story, but one with a sharp point to make. Sophie Barlow is currently the greatest star of Oneirofilms, the habit-forming entertainment which enables a spectator to *be* the hero or heroine of adventures in the grand style—especially sexual adventures. But Sophie longs for reality instead of make-believe. Until . . .

Previous anthologies have already made Stanislaw Lem, the remarkable Polish writer and futurist, and Josef Nesvadba, the Czech, familiar to American readers. (Two of Lem's novels are in the first Seabury Press lot, and I trust we'll see Nesvadba there later.) "In Hot Pursuit of Happiness" is one of a series of satiric stories which Lem has written about two cybernetic beings, Trurl and Klapaucius, who go about the universe experimenting with organic life. Here Trurl decides to create a world of utter happiness and blunders through experiment after experiment, never quite coming to the conclusion that there is something basically wrong about organic creatures. Nesvadba's story, "Captain Nemo's Last Adventure," is ironic rather than satiric (Swift would have loved Lem!) in its account of the future professional hero who comes back from his most challenging adventure (he saves the Sun from going nova), to find that his values no longer have much meaning in a world that doesn't even remember him.

The French stories are "The Valley of Echoes" by Gerard Klein, economist and psychologist as well as SF writer, and "Observation of Quadragnes" by J. P. Andrevon, artist, writer and critic of SF. Andrevon's story offers the rather familiar situation in which monstrous aliens are studying a man and a woman they have "collected" as specimens of humanity. The man is

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an American (tourist? student? GI?); the woman is a "good" housewife. They are stereotypes. Klein's story is one Ray Bradbury might have written, about a Mars where a group of explorers hope they have at last found Martians, but find only themselves.

The two other Russian stories are opposites. Vadim Shefner's "A Modest Genius" is really fantasy—the genius' miraculous (and wholly impossible) inventions, made to satisfy a trivial need or whim, whereas a "great" inventor's triumphs are utterly trivial but maintain his status. After all, he was selected to be an inventor. Could Shefner, an older writer, be saying something about Soviet bureaucracy? Sever Gansovski's "The Proving Ground" is a savage story about another inventor who has grown tired of making new weapons to win wars, and tries to make a tank that will make war impossible.

The Danish contribution, "The Good Ring" by Svend Age Madsen, is the magic wishing ring story with SF trappings. The ring a sour farmer finds is a gate that takes him into three alternate worlds. He can decide which he wants—and predictably does.

Finally, Herbert W. Franke, an Austrian living and writing in West Germany, has a wry ecological story in "Slum." Long after we have buried ourselves in our own wastes, an expedition from the cities under the sea goes ashore to see what may have happened to mankind. What they find is bad enough, but wait for Franke's last sentence.

As I said earlier, I think some of these stories would read better with better translators. Even so, I hope Franz Rottensteiner and Seabury Press bring us more.

HIERO'S JOURNEY

by Sterling E. Lanier • Chilton Book Co., Radnor, Pa. • 1973 • 280 pp. • $6.95

This is an old-fashioned "quest" book, no stranger to science fiction, in which a powerful hero is sent out through a perilous and largely unknown wilderness, infested by weird monsters and monstrous adversaries, to find the secrets of a "lost" civilization. Described that way, you might well shove the book into the ho-hum stack—and you'd be wrong. It doesn't have the qualities that make the author's "Peculiar Exploits of Brigadier Ffellowes" something special, but it does have touches of that book's humor, its sense of the macabre, its color and imagination.

Per Hiero Desteen, Secondary Priest-Exorcist, Primary Rover, and Senior Killman of the Metz Republic, lives in Canada of some 5,500 years hence, 5,000 years after "The Death" destroyed the great cities of North America, and probably of the rest of the world. His people are *metis*, a French Canadian-Indian mixture governed by a Church which has clung to memories of past science and has probed along other lines, especially along the borderland of psionics. The very shape of the continent has changed: the Great Lakes of our time are a huge inland fresh-water sea, bordered by strange marshes

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and inhabited by stranger creatures. Northward are the boreal forests, the Taig; south and east are the unknown, where Hiero hopes to find the legendary computers that made men great in the centuries before The Death.

Hiero's initial companions on his quest are Klootz the moose, a rather intelligent and somewhat telepathic mutant moose, and Gorm, an even brighter bear. You'll grow very fond of Gorm. Opposing them are mutant men, the Unclean, with terrific mental and scientific powers and a hideous host of lethal mutant animals as allies. There is a black princess of D'Alwah to be rescued . . . a naval battle on the Inland Sea . . . the utterly strange people of the trees to be helped and the utterly hideous House to be destroyed.

In a book of this kind, the detail is everything, and in "Hiero's Journey" the detail is beautifully and lovingly developed. I have a feeling that Hiero's journey isn't over. There's a lot of North America to explore, plus rumors of survivors on the other side of the world. Brother Aldo and the Central Institute, disciples of the Eleventh Commandment, may know more about them than Aldo has admitted. S'nerg of the Dark Brotherhood is still alive. And Gorm has a bear-sized curiosity to be satisfied.

THE MEN AND THE MIRROR
by Ross Rocklynne • Ace Books, New York • No. 52460 • 208 pp. • 95¢

Way back in Astounding's early years, the Gernsbackian principle of illustrating science through science fiction was very much alive. Oldtimers will remember the series of cops-'n'-robbers stories in which Ross Rocklynne put physics through its paces—and here they all are again, plus a late entry from 1952, which belonged in the original series but didn't make it.

In these stories—scientific problem stories, in which you are supposed to find a way out for the hung-up hero and villain—Lt. Jack Colbie of the Interplanetary Police keeps trying to catch supercrook Edward Deverel, who knows just a little more about mechanics than Colbie. They are suspended at the center of gravity of a hollow planetoid (Vulcan). They are floating in a strange and frigid lake on Jupiter, and have only a short time to find the one human depot on the gigantic planet. They are sliding back and forth across a nearly frictionless spherical mirror. They (actually, reasonable facsimiles) are back on Jupiter, trapped under a bubble. They are inside Vulcan again, trapped in a natural bottle partly filled with mercury. And—in a story that is supposed to show the error in the first one—six ruthless tycoons are trapped by one of their victims and forced into a survivor-take-all hexagonal duel to the death.

Somebody at Ace doesn't like readers. This sixth story begins halfway down the page on which the fifth one ends, without a title, a preamble, or any indication that it isn't more of the same story. It isn't in the list of contents, either. You figure it out.

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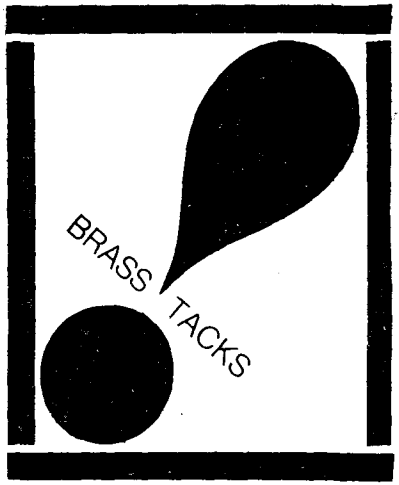

Dear Mr. Bova:

Gordon Dickson's "The Far Call" started me thinking about the relationship between politics and science. When the US depended on agriculture, politicians (defined as policy-makers, legislators, senators, et cetera) understood the problems of the farmer since all humans have the farming instinct. But when the US moved into an industrial base, politicians had to be businessmen and lawyers who understood the problems of industry. Now we are in a period during which in one generation our problems escalated out of the misuse of technology. The second-generation politicians didn't foresee the impact of technology on the economy/environment. *Thus, what is urgently required is politicians who are scientists.*

There are, for starters, four ways this can be done:

1. Build a computer specially programmed to make original, independent technological assessments (not moral or ethical decisions) to provide direction and warning.

2. Require politicians, especially the President, to have a minimum of a Bachelor's degree in a physical science.

3. Encourage more scientists to seek and attain political office.

4. Scientists may become politicians because they are the only people available for the job, that is, in a lunar or Martian colony.

Solution 1 is unlikely since the public is leery of computers. We would need one advanced enough to claim its own consciousness and independence; even then, its "oracle" decisions would be unacceptable to those who are in power and fear a change in the status quo.

Solution 2 is even more unlikely since politicians themselves set the standards for their office.

Solution 3 gives rise to the equation: Unemployed scientists plus much money equals scientists elected to policy-making office. This opens many opportunities but they are dependent on individual initiative combined into a massive group effort. Scientists are non-unionized and are taking the (unjust) blame for our problems; massive effort and money would be required. Unlikely.

Solution 4 depends on space travel. Since this is the solution that is farthest along, it is the best candidate of the four. But if only a group of scientist-politicians can effectively govern a technological

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society, then only the lunar/Mars colony will survive.

Meanwhile, on Earth, things can only get worse with purely political decisions made by the President and other politicians benefiting those who have the most to gain in the *short* run, glutting the environment. Sorry, friends, but the air will never be any cleaner nor the rivers any purer; the rich will get richer and the poor poorer. History tells us what will happen.

Meanwhile, the lunar colony's children will be interacting with ninth-generation computers, building 100-kilometer-diameter radio telescopes, not growing old, and building the first starships.

The conclusion is, as it stands now, if we are lucky enough to start independent lunar/Mars colonies, the human race and technology may survive. When someone says we should spend our space program money here on Earth and clean it up, just:

1. Make him/her read and believe "Beyond Jupiter" by A. C. Clarke, an epilogue to "First on the Moon" by Armstrong, Aldrin, and Collins, and "The Prometheus Project" by Gerald Feinberg, a very serious nonfiction book on the business of choosing mankind's long-range goals. (Educate.)

2. Run for your local or federal legislature and do a lot of talking and convincing during your twenty-hour day. (Work.)

3. Hope that you will meet the mental and physical standards to join the lunar/Mars colony. (Get the hell out.)

4. Recall to mind the cartoon with two cavemen standing around a fire with one saying: "But what else can it do besides make wood disappear?" (Laugh hysterically.)

Otherwise, I would expect that the next interstellar ship that visits Earth after 2001 will find nothing but the ruins of a promising technology on the North American continent—inhabited by highly intelligent farmers with a strange, unexplainable dread of machines.

A. JOHN MARTELLARO, JR.
Route 5, Box 670, Apt. F-2
Pensacola, Florida 32503

The first requirement of any solution is an electorate that understands the problem. A democracy rarely has "leaders" in high office—the people get the government they deserve. To solve science-oriented political problems, we desperately need science-aware voters!

Dear Mr. Bova:

Just a note to say how much I enjoyed Gordon R. Dickson's novel, "The Far Call." I got hooked on Mr. Dickson after reading his collection, "The Star Road," from the SF Book Club. He has a way with politics and SF that is a marked improvement over Allen Drury (and his "Throne of Saturn"). Like a colony away from its mother country, our astronauts are going to—if not already—have to sometimes decide for themselves what they are capable of handling in the course of their mission.

"An Earnest of Intent," along with "The Far Call," along with Watergate and other related subjects, has shown that politics when used unwisely and without any

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scruples can be just as destructive as the mightiest H-bomb. Maybe Alfred Bester had the right answer in "The Stars My Destination": stop treating the public like children, give them access to the country's deadliest secrets and then let them either learn to grow up and use them properly—or destroy themselves. The trouble with this country is that it loves to be secretive—my father thinks Tricky Dicky was doing right to hold the Watergate tapes in the name of national security. Me, I think he was being plain stupid . . .

And Nixon has the gall to preach morality!

RAYMOND J. BOWIE, JR.
31 Everett Avenue
Somerville, Massachusetts 02145

As has often been observed, "civil servant" usually translates to "civil master." Politicians become convinced that they know better than the electorate—and then prove it by keeping as much information to themselves as they possibly can.

Dear Sir:

It has been a long time since I have cried while reading a good science-fiction story. But when I finished "The Far Call" I did so with tears literally streaming down my face.

After a bout with the daily newspaper I often come away embittered toward the human race. Especially after reading about NASA program cutbacks and growing public disinterest in the whole space program.

Yet Mr. Dickson's story displayed the endless strength of the human spirit, in a situation which called for strict allegiance to a goal. A goal honorable to the human race as a whole.

In the story, no one was killed bravely in a war.

No one was martyred in a fever of hate.

And none expired with a pitiful whimper.

It was simply this: Two men gave their lives in a combination of love, vision, and determination, in order to allow the human race to continue its destined path to the stars. That was all that mattered.

In a battle between man's stupidity and his spiritual drive, the right side won. Thank you . . .

MATHEW B. DAVISON
P.O. Box 226,
Los Molinos, California 96055

"The Far Call" as serialized here is only about one-third of the book Gordon Dickson will eventually publish.

Dear Ben:

The Brass Tacks section in the September 1973 Analog is the most interesting and thought-provoking that has come along in some time . . .

I think an experience that I had in 1942 might have relevance to the problem. Shortly after Pearl Harbor I voluntarily entered into a special form of the welfare state. I was guaranteed food, housing, clothing, medical care, transportation, and a dole of twenty-one dollars a month for necessary expenses such as beer. It's true that I couldn't quit if I wanted to, but on the other hand I soon learned that there were fool-

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proof techniques for avoiding such onerous jobs as KP. After a few months in that particular sector I got bored and went off to OCS, but it seems to me that that particular experience has application to the present.

I'm not advocating putting those on welfare into uniform or herding them into barracks. What I am suggesting is that welfare be moved from a cash to a credit basis. Much is made of the alcoholic father who drinks up the relief check and leaves his children hungry. The first thing I discovered when I was in service was that I couldn't drink up the rent money if I wanted to—there wasn't any. The same was true of the food money and the clothing money. In short, if I gambled away my twenty-one dollars in a payday crap game, I still had rations and quarters for the rest of the month.

We've already made a number of moves toward a credit welfare economy. Subsidized low-income public housing and food stamps are good examples. I'd simply carry them to their logical conclusion. The purpose of welfare is to supply the needy with the basic necessities of life. I suggest that this can be done more efficiently on a credit basis than on a cash basis since this insures that funds will be expended for the purpose for which they were intended. Add to this adequate day-care centers and practical training programs, and a much greater percentage of those innocently trapped in the welfare maze will be able to move out if they so desire.

Special credit cards for the poor? Why not?

THEODORE R. COGSWELL

The purpose of welfare should *be to turn the recipients into productive individuals.*

Dear Ben:

Sometimes a relatively obscure fact can tell a great deal about a society or situation. For example, a glimpse of knitted stockings covering the "legs" of a table in a Victorian home could tell you what subject obsessed that repressive era.

A similarly small but highly significant fact was recently announced. RCA has agreed to underwrite the cost of upgrading the McDonnel-Douglas "Delta" launch vehicle until it has a 2,000-pound synchronous transfer capability. This will be done by substituting Castor IV external strap-on solid boosters for the nine smaller rockets now used (of which six fire for liftoff, three later in flight). And of course the object is to enable the Delta to place the forthcoming RCA commercial communications satellites into synchronous orbit. Otherwise NASA would be required to use a larger launch vehicle, or RCA cut back on the spacecraft weight.

The agreement includes having McDonnel-Douglas pay the government for direct costs of NASA engineering talent required in making the upgrade. The entire engineering and hardware change must be accomplished at a cost to RCA of approximately fifteen percent of the current price for a Delta vehicle.

There are sound business reasons

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why RCA has entered into such an unusual agreement. NASA, in a time of lean budgets, refused to underwrite the further development of the Delta vehicle. MacDac had no economic reason to do so. RCA found it could fund the upgrading of the Delta at less expense than launching satellites with the more powerful but also more expensive Atlas-Centaur. Hence common sense, for once, prevailed.

Two large corporations, both of which must make a profit to endure, have agreed on a space project and are willing to pay for NASA engineering talent to help it succeed. Think about that. . . .

A look at the NASA schedule for the Delta vehicle through 1982 (still far from complete) shows eight government-paid scientific missions and twenty-five reimbursable launches. The commercials include communications satellites for Brazil, Great Britain, a French-German venture, and of course American communications firms other than RCA. The Netherlands, Italy, Great Britain, and Canada are funding all or part of a series of scientific exploration spacecraft. India has future plans for communications satellites for strictly domestic uses, to reach outlying areas in the same manner planned by Brazil and now in use by Canada (with its two Telesat satellites, already launched by the Delta).

The Atlas-Centaur launch schedule shows a similar heavy bias in favor of reimbursable launches. The more powerful Titan-Centaur, now under development, has all scientific missions programmed at the moment—but so did the Atlas-Centaur and Delta in the past. And of course the Space Shuttle, destined to replace all three in the 1980's, will provide the same benefits at a considerably reduced cost per mission.

The point is clear. Space utilization, formerly a US-government-sponsored undertaking, is becoming the province of hard-headed businessmen and other governments. (Know why Canada paid the USA to launch two synchronous communications satellites? Because it was a heck of a lot cheaper than trying to lay land-lines to all those remote northern areas! And the same situation applies in Brazil, India, and many other countries.) This is happening for the best of reasons. Businessmen see a service to be performed, and a profit to be earned. Other nations see a way of achieving highly desirable technical objectives more cheaply from space than on the ground.

Many of us have long maintained the space program would eventually pay for itself, and not just by technical spin-offs. That day is rapidly arriving.

JOSEPH GREEN
1390 Holly Avenue,
Merritt Island, Florida 32952

Sounds like the first installments have already been paid!

Dear Ben:

The comments I have been receiving as a result of October's "Program for Star Flight" article have been exceedingly interesting as a phenomenon all of themselves. They fall into two general cate-

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gories: (a) the "Goddard Syndrome"; and (b) Clarke's "Failure of Imagination" Syndrome.

Only one person, a retired Navy captain who is also an SF writer, commented on the basic gist of the article: the programming. Basically, the unmanned interstellar probes must send back *two* bits of information: (1) "mission accomplished"; and (2) "yes-or-no" on the presence of a gas-giant planet.

The other comments have attempted to prove that the Enzmann starships won't work. Probably, as now visualized, they won't work . . . any more than the Moon rockets visualized in the 1930's would have worked if they could have been built. The important thing is that when a Moon rocket was built, the basic engineering concepts were the same as the 1930 concepts and the basic propulsion concepts had not changed. In respect to the starships, maybe the mass ratios are not precisely correct, and maybe we will have to build them larger . . . but they could be built, and the propulsion concept would give them interstellar range.

The Goddard Syndrome letters have attempted to prove mathematically that the starships are impossible gadgets. If you recall, many scientists and engineers attempted to prove that Goddard was wrong and that his rocket motors would not work . . . but they used the gas tables worked out for steam turbines.

The Failure of Imagination letters and comments have been based on just that. "How can we afford to build a starship that big and carry all that metal and deuterium into Earth orbit even if we could get the cost down to $1.50 per pound?" The failure of imagination, in this case, comes from a failure of systems thinking. About the only items we would bring up from the Earth's surface for this project would be people. "How could we possibly refuel a starship from a gas-giant planet?" That's another one. The answer: exactly the same way that we fueled it up in the first place from Jupiter. Of course, we do not have the nuts and bolts of the technology yet . . . but we will. These people should look again at the time scale of the program; we would not do it next Tuesday with what we know today.

One can only hope for the sake of our culture that the Goddard and Failure of Imagination Syndromes are not overly contagious. It seems they can be passed from generation to generation with changes only in degree, not kind.

Here we are back in 1920 again. Who is going to publish the equivalent of Oberth's book? Who is going to form the American Interstellar Society? Who is going to become the von Braun of star flight?

I am not going to argue nuts and bolts or the tenth decimal place with Analog's readers suffering from mental constipation. Star flight is not at that level of sophistication yet. It is only at the planning and concept stages . . . and I would enjoy batting things around at this level with *any* reader.

G. HARRY STINE

Is the von Braun—or Neil Armstrong— of star flight alive today?

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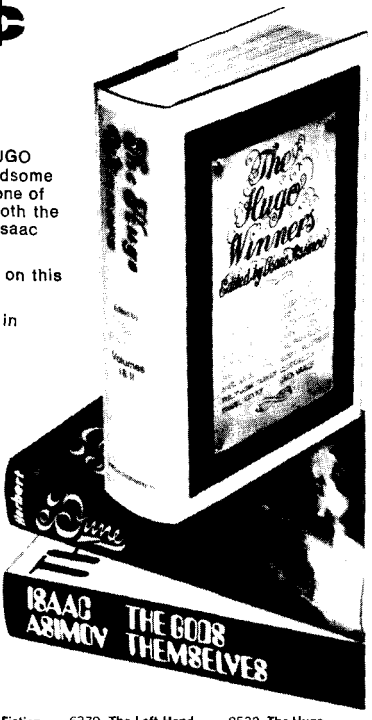

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